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NATIONAL DAM SAFETY PROGRAM. F. HOUSTON MCILVAIN DAM (MARSH CRE--ETC(U)
MAY 78 J H FREDERICK, W S GARDNER DACW31-78-C-0048

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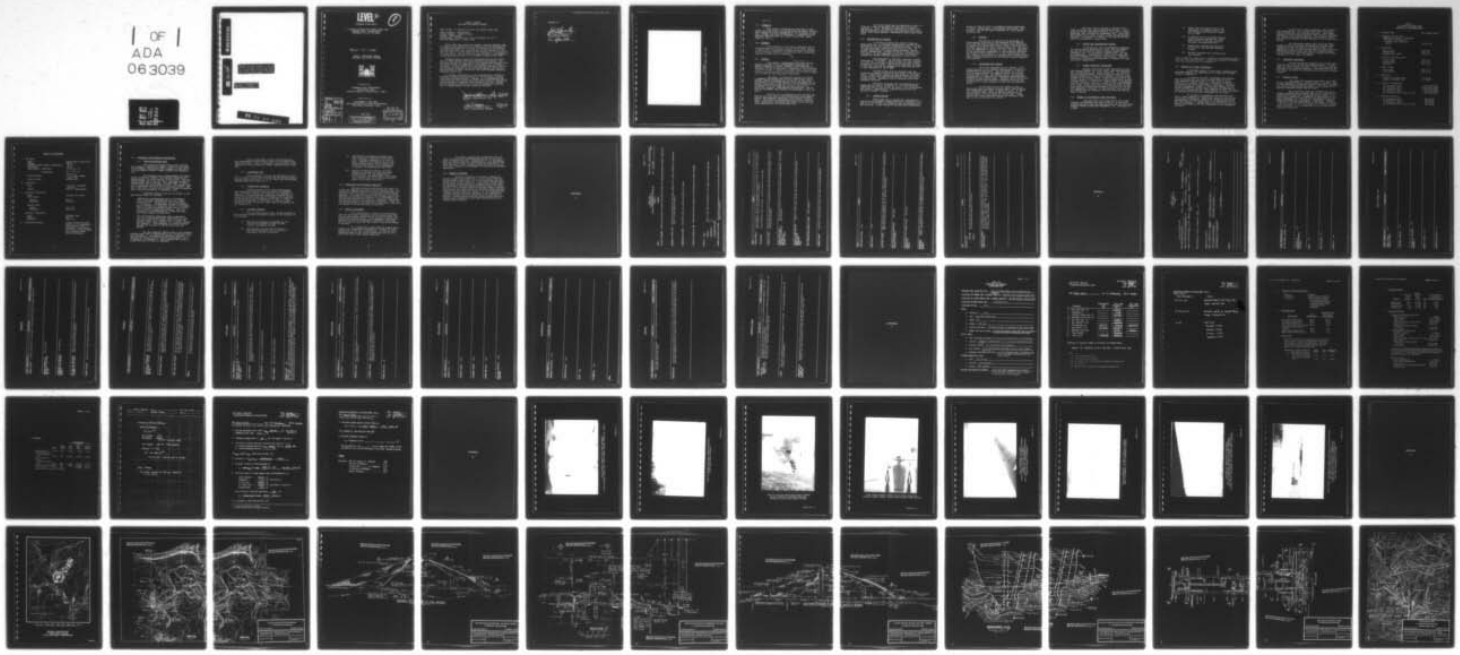

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National Dam Safety Program. F. Houston McIlvain Dam (Marsh Creek Dam) (National I.D. Number 00626), Delaware River Basin, Marsh Creek, Chester County, Pennaylwania Phase I Inspection Report)

10 John H. /Frederick, Jr.
William S. /Gardner

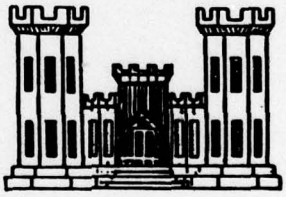
LEVEL II

DELAWARE RIVER BASIN

F. HOUSTON McILVAIN DAM (MARSH CREEK DAM)
CHESTER COUNTY, PENNSYLVANIA
NATIONAL I.D. NO. PA 00626

DACW31-78-C-0048

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

May 1978

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: F. Houston McIlvain Dam (Marsh Creek Dam)

State Located: Pennsylvania
County Located: Chester County
Stream: Marsh Creek
Coordinates: Latitude 40° 03.2' Longitude 75° 43.2'
Date of Inspection: 5 April 1978

Marsh Creek Dam, officially named F. Houston McIlvain Dam, is owned by the Commonwealth of Pennsylvania and Department of Environmental Resources. The dam was designed by an engineering firm experienced in dam practice and was completed in 1973. The facility is in good condition and has been in full operation for four years. The spillway has been designed to accommodate a flood approximating that of the probable maximum flood (PMF).

Complete design records are available and the most pertinent of these records have been reviewed and assessed. Construction records are also relatively complete and indicate that the construction was completed in accordance with the design documents. Visual inspection of the dam and reservoir facility did not detect symptoms of uncontrolled seepage, instability, deterioration or other conditions that would suggest impending hazardous conditions.

In summary, examination of the available data reveals no evidence or conditions detrimental to the integrity of Marsh Creek Dam and appurtenances. However, it is recommended that a definite plan for around-the-clock surveillance be implemented during periods of unusually heavy rainfall and that a formal warning system be established to notify appropriate personnel when a predetermined critical condition develops.

John H. Frederick, Jr., P.E. — Date 5/31/78
Maryland Registration 7301

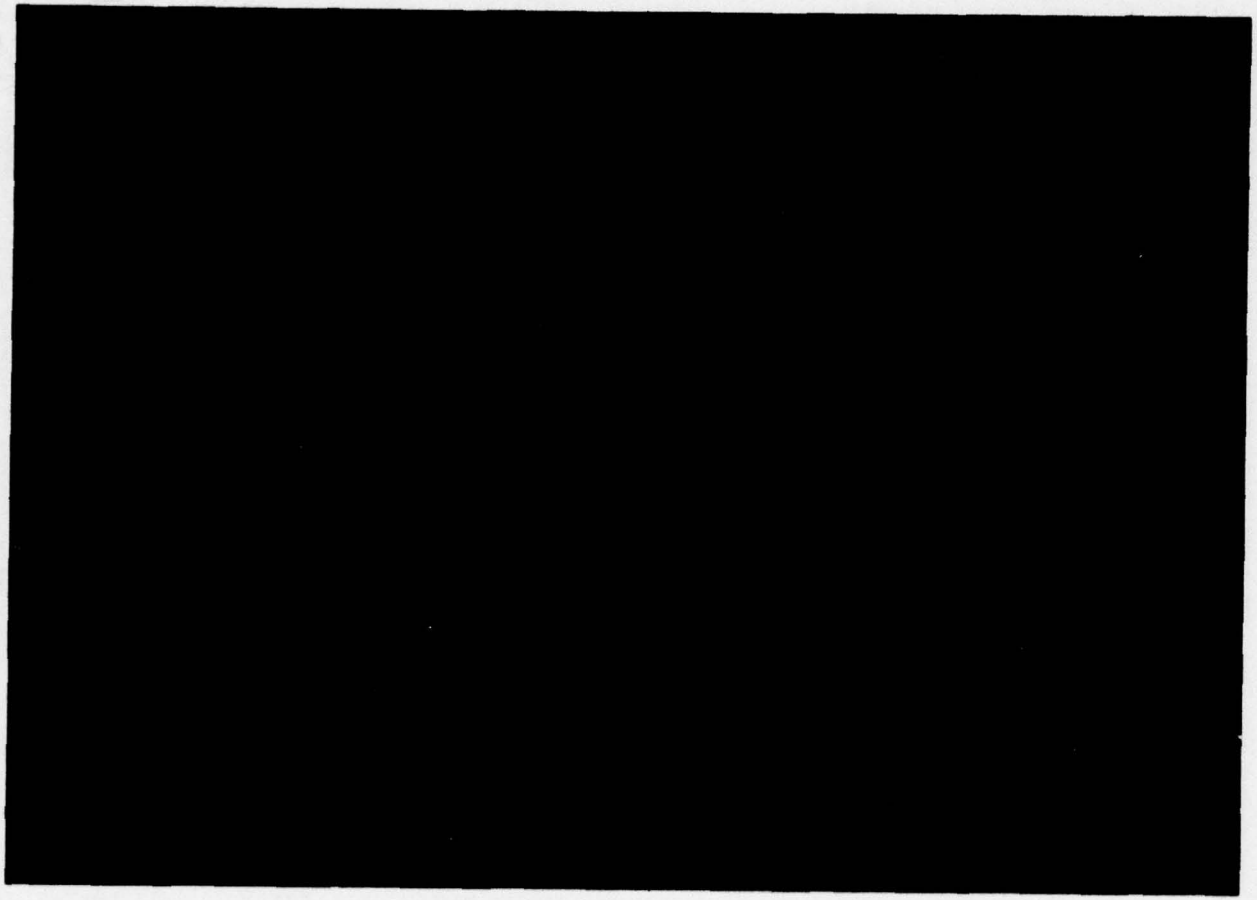
William S. Gardner, P.E. — Date 5/30/78
Penna. Registration 004302E

APPROVED BY:

John H Kenworthy

JOHN H. KENWORTHY
LTC, Corps of Engineers
Acting District Engineer

DATE: 14 June 1978



OVERVIEW
F. HOUSTON MCILVAIN DAM (MARSH CREEK DAM)

1.0 AUTHORITY

The Phase I investigation described in this report was made as part of the National Dam Safety Program. This program is being implemented by the Secretary of the Army, through the Corps of Engineers, in response to the National Dam Inspection Act, Public Law 92-367, dated August 8, 1972.

2.0 PURPOSE

The purpose of this visual inspection was to evaluate existing available records and to judge whether a need exists to implement emergency measures to counteract an existing condition or conditions which constitute hazards to human life or property.

3.0 GENERAL

This Phase I investigation followed the procedures outlined in the "Recommended Guidelines for Safety Inspection of Dams", issued by the Department of the Army, Office of the Chief of Engineers. The Guideline calls for review of readily available engineering and operational data pertaining to the project and a visual inspection of the dam and appurtenant structures.

The Phase I investigation seeks to provide a judgement concerning the risk of a dam failure and to suggest remedial measures for mitigation of this risk. The product of this investigation is an assessment of the general conditions of the facility and the formulation of an opinion as to the need for emergency measures or additional studies, investigation and analysis. The resulting assessment and opinions are described in this report.

The bulk of the engineering data reviewed was derived from the files of the Pennsylvania State Department of Environmental Resources in Harrisburg, Pennsylvania. The State has maintained active files on the design, construction, operation and review of all dam projects permitted by the State since 1914.

The field inspection was performed on April 5, 1978, by a team of engineers and geologists listed in Appendix B. Local information concerning the operation and maintenance of the facility was provided by Mr. Larry Smith, Park Superintendent, representing Marsh Creek State Park.

4.0 DESCRIPTION OF PROJECT

F. Houston McIlvain Dam, locally known as Marsh Creek Dam, is situated approximately one-half mile upstream of the East Branch of Brandywine Creek. The dam is a 90-foot high, zoned earth and rock fill dam. It crosses Marsh Creek in Upper Uwchlan Township, Chester County, Pennsylvania, as shown on Plate 1, Regional Location Plan. It was completed in 1973 and the reservoir reached the primary spillway elevation in June, 1974.

The embankment is 990 feet long with a crest elevation of 375.0 feet. The principal spillway consists of a box weir, located as shown on Plate 6, with a crest elevation of 359.5 feet. The concrete emergency spillway is 280 feet long and is designed as an ogee section with a crest elevation of 365.5 feet.

Minimum stream flow is released from the structure by means of 24-inch intake pipes in the control tower. Excess water passes over the principal spillway through a five foot pipe and discharges into the natural stream channel. Emergency flow is directed across the emergency spillway.

Pertinent technical data and dimensions are summarized on Table 1 in Section 5. An overview photograph and plan of the project is shown in the frontispiece and Plate 2, respectively. Typical sections are presented as Plates 3 through 7.

4.1 CLASSIFICATION

Marsh Creek Dam is classified, according to the Corps of Engineer's Guidelines as an intermediate size dam by virtue of both its height of dam and maximum storage capacity. Since failure of the dam would potentially

result in loss of lives to residents located downstream in Dorlan, Pennsylvania, and possibly Downingtown, Pennsylvania, the dam has been classified as a High Hazard Potential dam.

4.2 PURPOSE

The facility is owned by the Department of Environmental Resources of the Commonwealth of Pennsylvania and operated by employees of Marsh Creek State Park. It serves as a recreational, water supply, flood control, low flow augmentation, and irrigation facility. The structure was dedicated on October 11, 1975, and was sponsored by the Pennsylvania Department of Environmental Resources, the General State Authority, U.S. Soil Conservation Service, Chester County Board of Commissioners, Chester County Water Resources Authority and the Chester County Conservation District.

4.3 TOPOGRAPHY AND GEOLOGY

The entire drainage area is located in the Upland Section of the Piedmont Physiographic Province of southeastern Pennsylvania. The topography is a gently rolling upland surface of moderate relief, cut by many steep stream valleys. The bedrock within the reservoir drainage area is comprised of Precambrian metamorphosed sedimentary and igneous rocks. Regional uplift during the Triassic period has resulted in extensive faulting and intrusions of igneous material in the form of dikes and sills.

At the north end of the reservoir area, a major high angle northeast striking fault, identified as the Brandywine Manor fault, crosses the area. An east-west striking fault, known as the Gap overthrust, is located about 1.5 miles south of the dam site. These faults most likely occurred during late Paleozoic time and are not considered to be active.

The rock type at the dam is granodiorite, a light to medium gray, hard, medium-grained rock. Overlying the sound, unweathered bedrock is a zone of broken, weathered, and occasionally decomposed rock. This upper zone grades into a soft, friable, highly decomposed granodiorite. A residual soil mantle is as much as 30 feet thick is encountered in some areas.

4.4 DESIGN AND CONSTRUCTION HISTORY

In conjunction with the subsequent submittal of a construction application in 1966, the impoundment and dam was designed by Gannett Fleming Corddry and Carpenter, Inc., of Harrisburg, Pennsylvania. The dam was subsequently constructed in 1972-73 by Glasgow Construction Company of Glenside, Pennsylvania. Reservoir filling was initiated and completed in November 1973 and June 1974, respectively.

4.5 NORMAL OPERATING PROCEDURES

Monthly operations records maintained by the Park Superintendent, Mr. Larry Smith, were made available and reviewed during the visual inspection. As stated by the Park Superintendent, minimum required flows are maintained downstream by three Allis Chalmers, 24-inch valves located in the control tower. Flows are monitored by the USGS by means of a Stevens Flow Chart System which records a weekly history of the flows. Excess water is discharged over the principal spillway, located at the right abutment of the dam. Excess flood flow is channeled over the emergency spillway located approximately 400 feet left of the left abutment of the dam. It was reported that no water has passed over the emergency spillway since the dam has been in service.

5.0 SUMMARY OF ENGINEERING DATA AVAILABLE

Available data for review during this investigation was obtained from State files and a series of selected as-built drawings were obtained from the designers, Gannett Fleming Corddry and Carpenter, Inc. The data included:

(1) Report upon the Application of the Department of Forests & Waters and the General State Authority, November 9, 1966.

(2) A complete set of 43 design drawings which contained boring logs, plans and sections of the dam, grouting criteria, and specifications.

(3) Operational records were available at the site from the Park Superintendent.

(4) As-built drawings were obtained from the designer.

It is noted that there were no construction photographs available for this investigation. Additional sources of information are included herein as Appendix A.

6.0 RESULTS OF VISUAL INSPECTION

A detailed account of the visual inspection and recorded comments are presented on the Checklist included herein as Appendix B.

In general, the dam, impoundment and appurtenant structures are relatively new and found to be in good operating condition and in a good state of repair. There was no cracking, spalling, or excessive leaching of the concrete in the control tower or spillways. As documented in Appendix B (Page 6), some minor seepage was observed through the control tower immediately below the intake pipe at elevation 338. This seepage is minor and should be repaired during routine maintenance of the tower.

No evidence of sloughing, uncontrolled seepage or other symptoms of malfunction along the face or toe of the dam was detected. Some minor seepage was observed approximately 50 feet downstream of the downstream toe of the left abutment. A marshy area with willows was also observed approximately 300 feet downstream of the emergency spillway.

At the time of this inspection, the reservoir was approximately 1 to 2 inches above normal pool with water flowing over the principal spillway. The exposed portions of the principal spillway were visually inspected and found to be in good condition. The emergency spillway was fully exposed and also appeared to be in good condition.

The discharge channel and flood plain downstream of both the primary and emergency spillways were inspected to the confluence of Brandywine Creek. The channel was clear of obstructions with the exception of an abandoned railroad bridge and operating highway bridge. For the most part, the flood plain is covered with trees ranging up to 36 inches in diameter.

7.0 OPERATING PROCEDURES

Written operating procedures and records were supplied for review by the Park Superintendent. In addition, all three intake butterfly valves were exercised and appeared to be operating properly. Park personnel are onsite daily and check the structure during periods of heavy rainfall.

8.0 WARNING SYSTEM

The inspection revealed that there is no monitoring instrumentation or warning systems in effect. The written operating procedures, however, describe a procedure for notifying appropriate personnel if any unusual or apparently hazardous conditions are found.

The inspection team was informed that water levels, discharge and selected items of the structure are inspected each week day, and during severe storms. If, during this inspection, a condition is observed which appears hazardous, the condition is documented and the appropriate authority is contacted. Reportedly, regular inspections are performed yearly by the Owner. To ensure a quick response to the development of potentially hazardous conditions, it is recommended that a formal warning system be installed.

TABLE 1
F. HOUSTON McILVAIN DAM
SUMMARY OF PERTINENT DATA

1.	Drainage Area	20.0 square miles
2.	Discharge at Dam Site Combined Principal & Emergency Spillway [Discharge at Maximum Pool Elevation (PMF)]	28,500 cfs
3.	Elevations	
	Top of Dam	375.0 ft.
	Normal Pool	359.5 ft.
	Maximum Pool (PMF)	374.8 ft.
	Principal Spillway Crest	
	First Stage	359.5 ft.
	Second Stage	367.5 ft.
	Emergency	365.5 ft.
	Water Intake	
	Low Intake	288.5± ft.
	High Intake	338.0± ft.
4.	Reservoir	
	Length of Maximum Pool	2.9 miles
	Length of Normal Pool	2.7 miles
5.	Storage (Incremental)	
	To elevation 315.0	1,230 Acre-Feet
	To elevation 359.5	12,470 Acre-Feet
	To elevation 365.5	3,560 Acre-Feet
	To elevation 374.8	6,380 Acre-Feet
	To elevation 375.0 (top of dam)	360 Acre-Feet
6	Reservoir Surface	
	At elevation 359.5	535 Acres
	At elevation 365.5	640 Acres
	At elevation 374.8	776 Acres
	At elevation 375.0 (top of dam)	780 Acres

TABLE 1 (continued)

7. Dam Data	
Type	Zoned Earth & Rock Fill
Length	990 ft.
Maximum Height (above foundation)	90 ft.
Top Width	26 ft.
Side Slopes - upstream	2.75 H to 1 V
- downstream	2.5 H to 1 V
	2 H to 1 V
Cutoff Trench	30 ft. wide, impervious fill
Grout Curtain	Triple line
8. Diversion	
Type	6 ft. dia. concrete conduit
Length	440 ft. (approximate)
9. Spillway (Principal)	
Type	Concrete Box Inlet
First Stage	
Length	16 ft.
Elevation	359.5 ft.
Second Stage	
Length	13.67 ft.
Elevation	367.5 ft.
Spillway (Emergency)	
Type	Concrete Ogee
Length	280 ft.
Elevation	365.5 ft.
10. Downstream Channel	Channel enters the East Branch of the Brandywine approximately 3000 ft. below dam. Sections potentially to flood damage are located on East Branch Brandywine.

9.0 HYDROLOGIC AND HYDRAULIC EVALUATIONS

9.1 DESIGN EVALUATION DATA

The readily available design data reviewed was limited to application reports located in the files in Harrisburg, Pennsylvania and a summary of dam statistics provided by Gannett Fleming Corddry and Carpenter, Inc.

The drainage area is approximately 20 square miles, irregularly shaped, with maximum dimensions of approximately 7.6 miles long by 3.9 miles wide. The elevations range from a high of 750 in the upper reaches to approximately 300 at the dam. The topography is gently rolling with many steep stream valleys. The current land use is open/farm land with 40 to 50 percent wooded. However, the area is located on the outer fringes of suburbia and is being developed as a residential area.

Hydrologic design criteria are stated in the Application Report as follows:

> "Hydrologic investigations were in accordance with the methods developed by the Soil Conservation Service. Design flood flows were based on two storms. The Emergency Spillway hydrograph was calculated by routing the runoff (13.8 inches) from 12.5 times the maximum 6-hour point rainfall (12.2 inches) through the reservoir. This resulted in a peak discharge of 12,600 cubic feet per second through the spillway.
>
> "The No-Freeboard Hydrograph used to determine the top of dam elevation was established by routing the runoff (24.8 inches) from 2.5 times the maximum 6-hour point rainfall (12.2 inches) through the reservoir. This resulted in a peak discharge through the spillway of 28,500 cubic feet per second".

The "No-Freeboard" design storm is the probable maximum flood (PMF) as determined by Soil Conservation Service procedures. The summary of hydrologic analysis, as supplied by Gannett Fleming Corrdry and Carpenter, Inc., is presented in Appendix C. The estimated PMF inflow is 36,000 cfs with 0.2 feet of freeboard.

Under established criteria (OCE Guidelines), the recommended spillway design flood is the probable maximum flood (PMF). This is consistent with the size (intermediate) and hazard potential (high) classification of the dam.

9.2 EXPERIENCE DATA

Since reservoir filling was completed in June 1974, no major floods have occurred and the emergency spillway has never functioned. It is not known what the maximum recorded reservoir elevation is.

9.3 OVERTOPPING POTENTIAL

Although copies of the inflow hydrographs were provided by Gannett Fleming Corddry and Carpenter, Inc., only peak outflows were supplied (see Appendix C); therefore, calculations were performed to assess the accuracy of the peak discharge and maximum water elevation in the reservoir during passing of the PMF. A check of the storage available is sufficient to contain a peak inflow of 36,000 cfs during a PMF without overtopping the dam (Appendix C).

9.4 SPILLWAY ADEQUACY

The following observations, primarily based on the available design information, apply to the adequacy of the spillway.

(1) The spillway system as designed and constructed is adequate to pass the PMF without overtopping the dam.

(2) The tailwater at the time of passing of the PMF is estimated to be 20 feet or more below the top of the dam.

(3) The maximum non-damaging discharge has been listed as 12,600 cfs on the Check-list, included as Appendix C to this report. However, this applies only to the channel downstream of the structure and above the East Branch of the Brandywine, a distance of approximately 3000 feet.

(4) Sections potentially subject to flood damage are located near the confluence of Marsh Creek and the Brandywine (a small factory) and downstream. This structure controls only 20 of the more than 54 square miles above this point.

10.0 EVALUATION OF STRUCTURAL STABILITY

The design drawings and design data were reviewed and compared with the available as-built data. All structures observed appeared to be in good condition and appeared to be constructed in accordance with the design drawings. The stability analysis and seepage control procedures were reviewed and found to be in accordance with the current state-of-the practice. Operating records were reviewed and found to be essentially complete. Since the dam and appurtenant structures were constructed, there were no changes to the design noted or observed.

11.0 OVERALL ASSESSMENT

The limited Phase I review of the available data and the visual inspection indicate Marsh Creek Dam and its appurtenant structures are in good condition and functioning satisfactorily. The independent hydrologic/hydraulic evaluation presented in Appendix C indicates that the dam will pass the PMF without significant damage to the dam.

It is noted that severe property damage would probable be experienced downstream as a result of large floods even if the dam in unimpaired. If warning of an impending flood is not issued, downstream loss of life could also occur under these conditions.

In summary, examination of available data reveals no evidence of conditions detrimental to the integrity of Marsh Creek Dam. Consequently, it is recommended that the current level of surveillance be continued by the Owner and that a formal warning system be installed to insure quick response to development of potentially hazardous conditions.

12.0 REMEDIAL MEASURES

With the exception of the minor leakage observed through the concrete wall in the control tower below the upper intake pipe, all of the structures are concluded to be in good condition. This minor leakage should be corrected during routine maintenance work in the tower. All Operations and Maintenance procedures should be maintained in an up-to-date condition and the names of responsible parties to contact during an emergency should be made readily available and kept current. It is recommended that a formal warning system be installed to warn appropriate authorities when a pre-determined critical condition is reached. Around-the-clock surveillance systems should be enacted during abnormally high flows associated with unusually heavy rainfall.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *F. Houston McIlvain Dam*

ID # *PA 00626*

ITEM	REMARKS
AS-BUILT DRAWINGS	*These were available reviewed and checked during the inspection against as-built conditions.*
REGIONAL VICINITY MAP	*This map was provided with the design drawing and a similar drawing is enclosed as Plate 1 of the Inspection Report.*
CONSTRUCTION HISTORY	*Very little data was readily available for review.*
TYPICAL SECTIONS OF DAM	*These sections were presented in the design and as-built drawings.*
OUTLETS - PLAN	
DETAILS	*All of this data was presented in the design and as-built drawings.*
CONSTRAINTS	
DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	*The records are maintained at the site and were made available for review during the inspection.*

ITEM	REMARKS
DESIGN REPORTS	*Design drawings (report) were available for review as prepared by SCS which contained data relevant to the dam and appurtenant structures.*
DESIGN DWGS:	*Design drawings contain 43 sheets. As-builts were not on the site.*
GEOLOGY REPORTS	*Geology data was included in the application permit and in the design reports. All of this data was reviewed.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*This data was presented in the design reports and design drawings. All of which were reviewed.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*Results of these tests and data were presented in the design report.*
POST-CONSTRUCTION SURVEYS OF DAM	*None available.*
BORROW SOURCES	*Locations of these proposed sources were noted on the design drawings.*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*None*
HIGH POOL RECORDS	*These records were available for our review. Design records allow for a maximum flow of 28500 cfs at zero freeboard with 5.1 feet over the spillway.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None known.*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None known.*
MAINTENANCE OPERATION RECORDS	*Operational records were reviewed and emergency procedures were reviewed at the park manager's office. Maintenance records were not readily available for review.*

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	*Sections and details of these spillway features were noted on the as-built drawings and the structure was inspected in the field.*
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	*All mechanical operating equipment inside the control tower was inspected and the valves were exercised. The control tower houses a U.S.G.S. Stevens flow gage which is read weekly. The discharge flow is controlled by a 16" cone valve and 3 Allis Chalmers 24" butterfly valves. All are rated 150FP. The butterfly valve numbers are 65844, 65843-1 and 65843-2.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *F. Houston McIlvain Dam (Marsh Creek Dam)* County *Chester* State *Pennsylvania* National ID # *PA 00626*

Type of Dam *Rockfill with impervious core* Hazard Category *I (High)*

Date(s) Inspection *April 5, 1978* Weather *cool, partly cloudy, windy* Temperature *50°±F*

Pool Elevation at Time of Inspection *360.0* M.S.L. Tailwater at Time of Inspection *-* M.S.L.

Inspection Personnel:

John H. Frederick, Jr. (Geotechnical) *Vince McKeever (Hydrologist)* *Mary Beck (Hydrologist)*

Noel Ravneberg (Geologist) *Ray Lambert (Geologist)*

John Boschuk, Jr. (Geotechnical)

John Boschuk, Jr. Recorder

Remarks:

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*Surface cracks were not observed in the embankment during the visual inspection.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*None observed.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*There were no significant vertical or horizontal distortions observed along the crest or slopes of the embankment.*	
RIPRAP FAILURES	*There were no riprap failures observed above the pool level.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*Some minor erosion at junction of the dam embankment and left abutment along the downstream slope was observed. However, this zone is "rocky" and the channel appears to be quite stable.*	
ANY NOTICEABLE SEEPAGE	*Some seepage (standing water) was observed in a flat area approximately 50 feet downstream of the downstream toe. This flattened area prepared during construction grades into the existing marsh land further down stream.*	
STAFF GAGE AND RECORDER	*The park personnel keep daily records of the reservoir surface elevation and the U.S.G.S. reads their gages weekly. The U.S.G.S. station is located approximately 900 feet downstream of the primary spillway outlet channel and a recording gage is located in the control tower.*	
DRAINS	*Toe drains in the downstream side of the structure and relief drains appear to be functioning properly at the emergency spillway.*	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*None observed in the primary intake structure and intake tower.*	
INTAKE STRUCTURE	*The principal spillway was operating properly and the trash racks were clean. Some sedimentation has developed along the right side of the structure but is not restricting the flow.*	
OUTLET STRUCTURE	*It appears to be working satisfactory.*	
OUTLET CHANNEL	*There was no erosion observed.*	
EMERGENCY GATE	*N/A*	
CONTROL TOWER	*With the exception of one seep, the control appears to be in good condition. No cracks were observed. However, several small seeps were breaking through the concrete on the north wall of the tower at elevation 332 and 334 and located below the 24" intake at elevation 338. Some small seepage was also coming through the elevation 330 construction joint on the same wall. Leachate (calcite) was accumulating on the floor below.*	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*The emergency spillway is 280' long and the drains appear to be functioning properly.*	
APPROACH CHANNEL	*There is slight sloughing on each side of the channel. This is normal for the highly fractured nature of this rock.*	
DISCHARGE CHANNEL	*There is also minor sloughing on both abutments of this channel. Willows are starting to grow about 300 feet below spillway in a wet zone which is probably seepage under the foundation or from the hillside.*	
BRIDGE AND PIERS	*N/A*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*N/A*	
APPROACH CHANNEL	*None*	
DISCHARGE CHANNEL	*None*	
BRIDGE AND PIERS	*None*	
GATES AND OPERATION EQUIPMENT	*None*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*The slopes are gentle and grassy. There was no significant erosion observed and the woods come up to the water line in some places.*	
SEDIMENTATION	*A very minor amount of sedimentation was observed at the extreme upper end of the reservoir. This minor sedimentation does not appear to affect the flood storage capacity of the reservoir.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*Immediately below the stilling basin, no debris or obstructions were observed. The rip-rap appears to be in good condition. The outlet from the emergency spillway discharges into a wooded area approximately 500 to 600 feet below weir. There are no problems expected.*	
SLOPES	*Both outlet channels were inspected and appeared to be stable. The bank and gradient slopes are visually in good condition.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*Approximately 10-15 homes are located along the East Branch of the Brandywine above the Dowingtown area where major damage to homes and businesses could occur.*	

APPENDIX

C

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *farm w/ 40-50% wooded, area is developing as suburbia.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *elevation 359.5 storage 14,000 Ac-ft.*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *top dam storage = 24,000 Ac-ft*

ELEVATION MAXIMUM DESIGN POOL: *elevation 370.6*

ELEVATION TOP DAM: *375.0*

CREST:

a. Elevation *375.0*

b. Type *Earth and Rockfill dam*

c. Width *26'*

d. Length *990 feet*

e. Location Spillover *emergency spillway cut through rock-500' east of dam*

f. Number and Type of Gates *3 intake water supply pipes (24" dia.) in addition to ungated primary and emergency spillways.*

OUTLET WORKS:

a. Type *principal spillway (weir inlet which converges to a 5' ϕ conduit).*

b. Location *Principal-located at the right abutment, Emergency-left side of dam.*

c. Entrance inverts *359.5 principal; 365.5 emergency*

d. Exit inverts *284.75 from principal spillway; natural stream channel-emergency*

e. Emergency draindown facilities *a 6 foot diversion pipe is located at the base of the dam and controlled at the intake tower.*

HYDROMETEOROLOGICAL GAGES:

a. Type *None observed*

b. Location *None observed*

c. Records *None observed*

MAXIMUM NON-DAMAGING DISCHARGE: *12,600 cfs (with a freeboard of 4.4 feet.)*

Downstream areas subject to damage located on East Branch of the Brandywine.

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

WCC Job No.: 78C015-15
Date: 4/3/78
By: MFB
Sheet: 2 of 9

DAM Marsh Creek Nat. ID No. PA00626 DER No. 15-296

	ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1.	Min. Crest Elev., ft.		975.0 ft	
2.	Freeboard, ft.		0.2 ft	
3.	Spillway(1) Crest Elev, ft.		965.5 ft	
3a.	Secondary(2) Crest Elev, ft.	—	-	
4.	Max. Pool Elev., ft.		974.8 ft	
5.	Max. Outflow(3), cfs		28,500 cfs	
6.	Drainage Area, mi²	20 mile²	20 sq. mile	20.02 mile²
7.	Max. Inflow(4), cfs	36,000 cfs	36,000 cfs	
8.	Reservoir Surf. Area		535 Ac	508 Ac
9.	Flood Storage(5)		9940 Ac-ft	
10.	PMF Runoff	24.8 inches	24.8 inches	

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

(1) Main emergency spillway.

(2) Secondary ungated spillway.

(3) At maximum pool, with freeboard, ungated spillways only.

(4) See Sheet 5.

(5) Between lowest principal spillway and maximum pool.

Date: 4/5/78
By: MFB
Sheet: 3 of 9

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)
Marsh Creek

Item (from page 1)	Source
6A, 7A, 10A	Application Report, Harrisburg files, dated Sept. 24, 1968
1B through 10B	Information supplied by Gannett Fleming Corddry & Carpenter, Inc.
6C, 8C	USGS Maps Downingtown (1973) Pottstown (1973) Elverson (1969) Wagontown (1969)

b. Location of Dam and Reservoir

County	Chester
Townships	Upper Uwchlan, Wallace
Watershed	Marsh Creek, a tributary of East Branch Brandywine Creek which flows into Brandywine Creek a tributary of the Delaware.

c. Drainage Areas

Description	Area square miles	Percent of total Brandywine Creek Basin
Brandywine Creek Basin	330.0	100.0
West Branch Brandywine	134.6	40.8
East Branch Brandywine	123.3	37.4
East Branch above Downingtown	62.2	18.8
East Branch above Marsh Creek	34.0	10.3
Marsh Creek above mouth	20.23	6.1
Marsh Creek above dam site	20.0	6.1

d. Stream Flow

Flow at the dam site was synthesized from U.S.G.S. gaging station records at Chadds Ford, Wilmington, Downingtown, Lyndell and Honeybrook. The combined period of record extends continuously from August 1911 through September 1961.

Mean daily runoff at dam site:	mgd	cfs	cfs/sq.mi.
1. mean daily of record	14.48	9.35	0.47
2. mean daily of minimum 365 consecutive days	6.46	4.17	0.21
3. mean daily of minimum day	2.33	1.51	0.08

e. Floods of Record

Station	Drainage area sq.mi.	Instantaneous peak cfs	csm	Jarvis-Meyers coefficient $C = csm \times (area)^{1/2}$
Wilmington	314	17,800	57	1,010
Chadds Ford	287	17,200	60	1,020
Downingtown	81.6	5,180	63	570
Coatesville	45.8	3,670	80	540

f. Design Flood Data

Emergency Spillway design flood

Duration of storm	6 hours
Total rainfall	15.25 inches
Total runoff	13.8 inches
Reservoir stage at start of flood	359.5 feet
Peak inflow	19,000 cfs
Maximum surcharge storage elevation	370.6 feet
Peak outflow	12,600 cfs

"No Freeboard" design flood

Duration of storm	6 hours
Total rainfall	30.5 inches
Total runoff	24.8 inches
Reservoir stage at start of flood	Elev. 359.5 feet
Peak inflow	36,000 cfs
Maximum surcharge storage elevation	374.8 feet
Peak outflow	28,500 cfs

Outlet works and Principal Spillway operating procedure: It was assumed that the outlet works discharge facilities would be inoperative. It was further assumed that the principal spillway would be fully operative.

Diversion Flood

Flood flow frequency	5 years
Total runoff (approximate)	0.83 inches
Peak Inflow	1,200 cfs
Maximum surcharge storage elevation	304.3 feet
Peak outflow	508 cfs

g. Reservoir

	Elev.	Area acres	Net Storage Acre feet	Net Storage Accum. acre feet	Runoff inches
Recreation pool	315.0	100	1,230	1,230	1.15
Water supply pool					
Principal spillway	359.5	535	12,470	13,700	12.84
Flood control retention					
Emergency spillway	365.5	640	3,560	17,260	16.18
Maximum surcharge	374.8	776	6,380	23,640	22.16
Top of dam	375.0	780	-	24,000	22.50

Maximum fetch is about 1.7 miles.

BY MFB DATE 4/6/78 SUBJECT Marsh Creek SHEET 7 OF 9

CHKD. BY DATE JOB No.

Emergency Spillway Discharge

Maximum Discharge

$Q = C_L H^{3/2}$

Top of Dam 375.0
Em. Spillway 365.5
9.5 ft = Maximum Head

Weir Length 280 ft (field checked)

Assume $C = 3.66$

$Q = 3.66 \cdot 280 \cdot 9.5^{3/2}$

= 30,000 cfs > 28,500 used in design

Flood Storage

Use values supplied as they are based on a site survey

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC CALCULATIONS

Date: 4/6/78
By: VM / MFB
Sheet: 8 of 9

DAM Marsh Creek Nat. ID No. PA 00626 DER No. 15-296
Calculations for *Design* ☐, *As-Built* ☑, *Existing* ☐ Conditions

1. Spillway Discharge at Max. Pool*, Q_{omac} 28,500 cfs (See Sheet 5, Section F)
   Freeboard at Max. Pool 0.2 ft.

2. Tributary Drainage Area*, A 20 mi^2 (see Sheet 4, Section C)

3. From Gannett Fleming Corddry & Carpenter Data (Sheets 4, 5, 6)
   a) Inflow hydrograph peak flow, Q_{Imax} 36,000 cfs at 100% PMF
   b) Inflow hydrograph duration, T — hrs.

IF Q_{omax} exceeds Q_{Imax}, check here and stop ☐

4. Calculate $p = Q_{omax}/Q_{Imax}$ = 28,500/36,000 = 0.7917.

5. Calculate Volume of inflow hydrograph, V_I

$$V_I = \text{~~1000 } Q_{Imax} \text{ T = 1000~~} \times \frac{24.8}{12} \times .20 \times 640 = 25,453 \text{ ~~ft}^3\text{~~ Ac-Ft.}$$

6. Calculate volume of storage between normal and maximum pool, V_s

   Crest Elevation = 375.0 ft.
   Freeboard** = 0.2 ft. (See Sheet 2)
   El. Max. Pool = 374.8 ft.
   El. Normal Pool** = 359.5 ft. (See Sheet 5, Section F)
   Storage Height = 15.3 ft.

   Area of reservoir from USGS quad sheet*, N/A ft^2

   V_s = ~~Storage Height x Area~~ = 9940 ~~ft^3~~ Ac-ft.

IF V_s exceeds V_I, check here and stop ☐.

---

* *Attach calculations or source.*
** *Attach justification for values selected.*

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Date: 4/6/78
By: VM/MFB
Sheet: 9 of 9

DAM Marsh Creek

Design ☐, *As-Built* ☑, *Existing* ☐

7. Calculate storage required to pass flood, V_R

$V_R = (1-p)\ V_I$ = (1 -.7917) x 25,453 = 5311 ft³ Ac-Ft.

IF V_s exceeds V_R, check here and stop ☑ .

8. Calculate freeboard storage, V_F

V_F = Freeboard x Area = _____ x _____ = _____ ft³

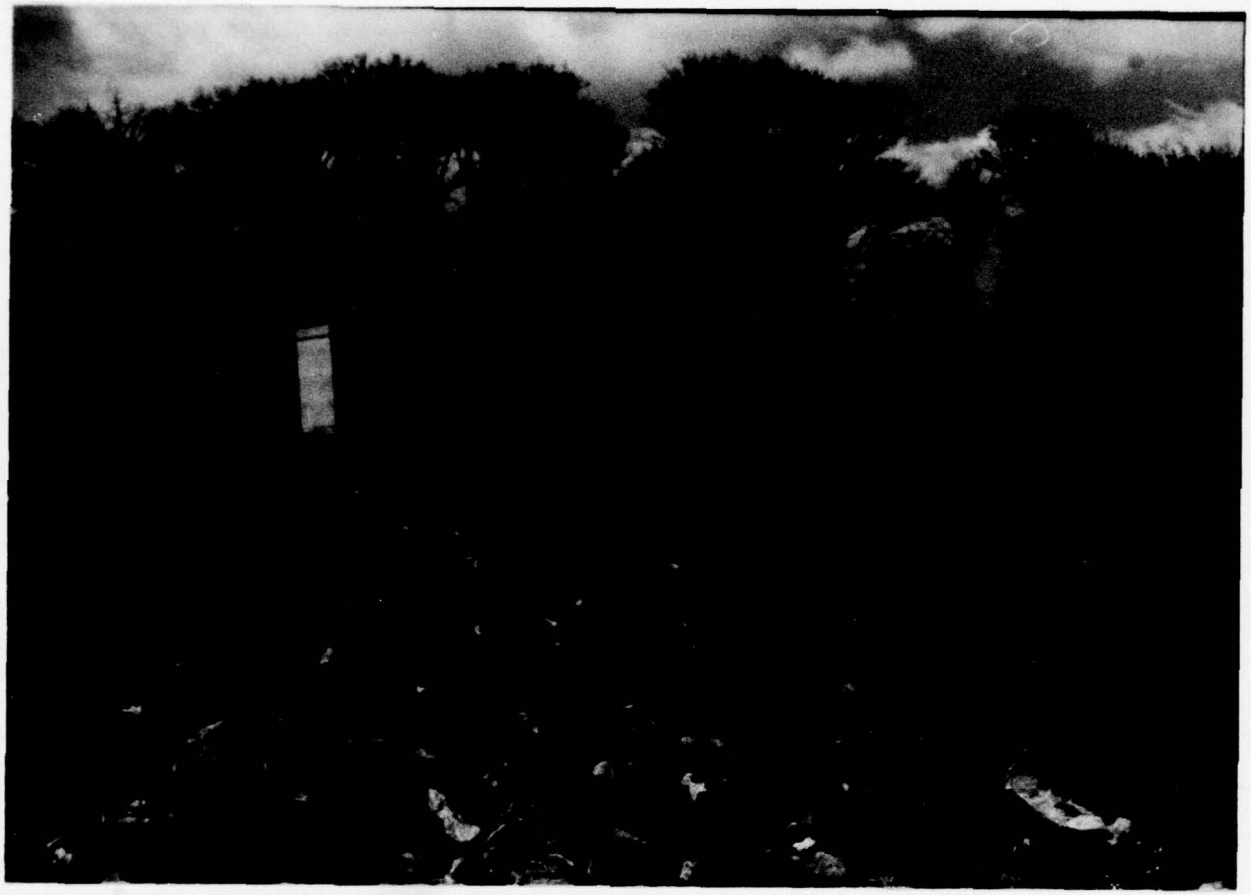
Does V_R exceed $V_S + V_F$? _____. If yes, repeat for 1/2 PMF, if this calculation is for 1/2 PMF, and answer is still yes, dam may be unsafe.

SUMMARY

Dam passes
- PMF with 0.2 ft. freeboard . . . ☑
- PMF with no freeboard . . . . . ☐
- 1/2 PMF with _____ ft. freeboard . ☐
- 1/2 PMF with no freeboard . . . . . ☐
- None of the above . . . . . ☐

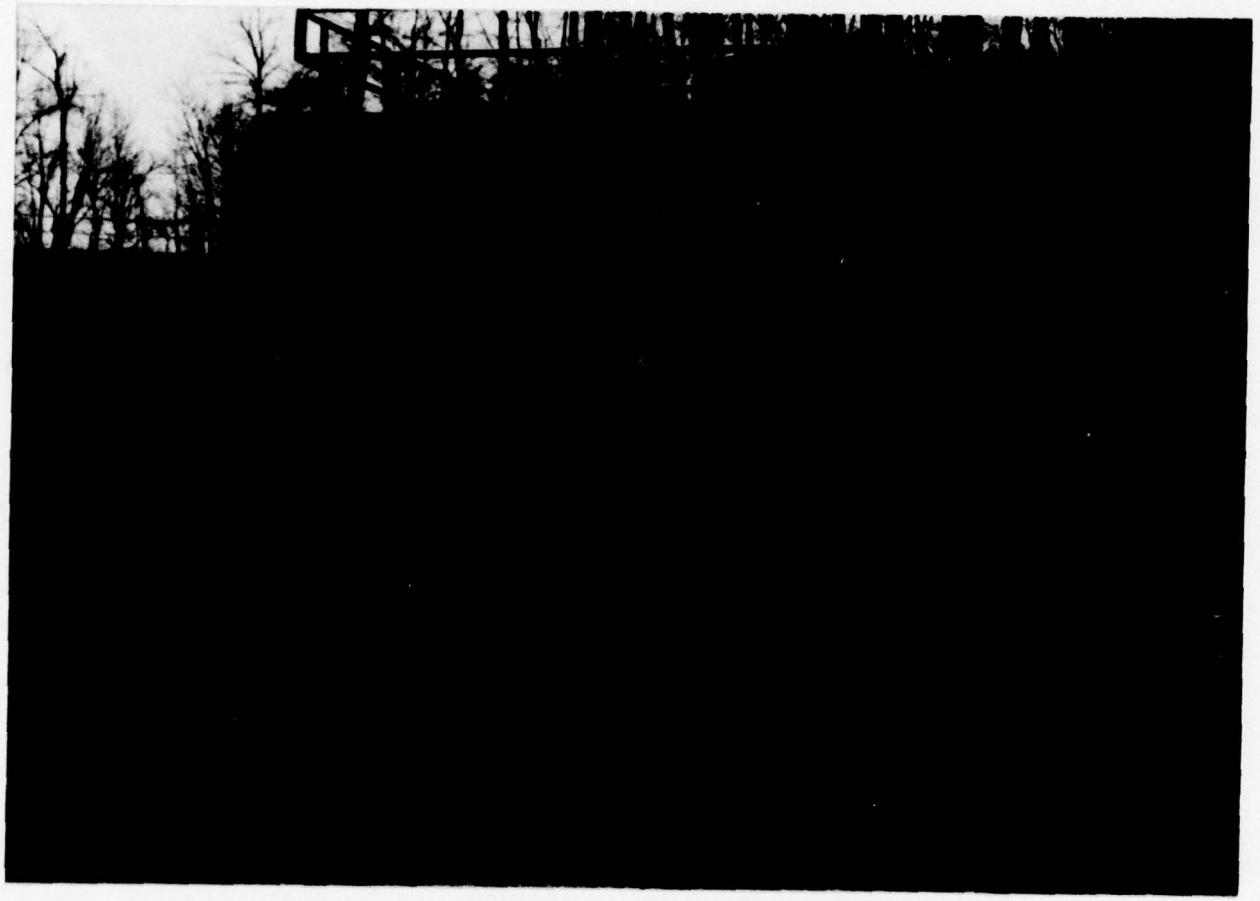
APPENDIX

D



VIEW LOOKING TOWARDS THE RIGHT ABUTMENT
AT THE CONTROL TOWER (LEFT) AND PRIMARY INTAKE STRUCTURE (RIGHT).

PHOTO NO. 1

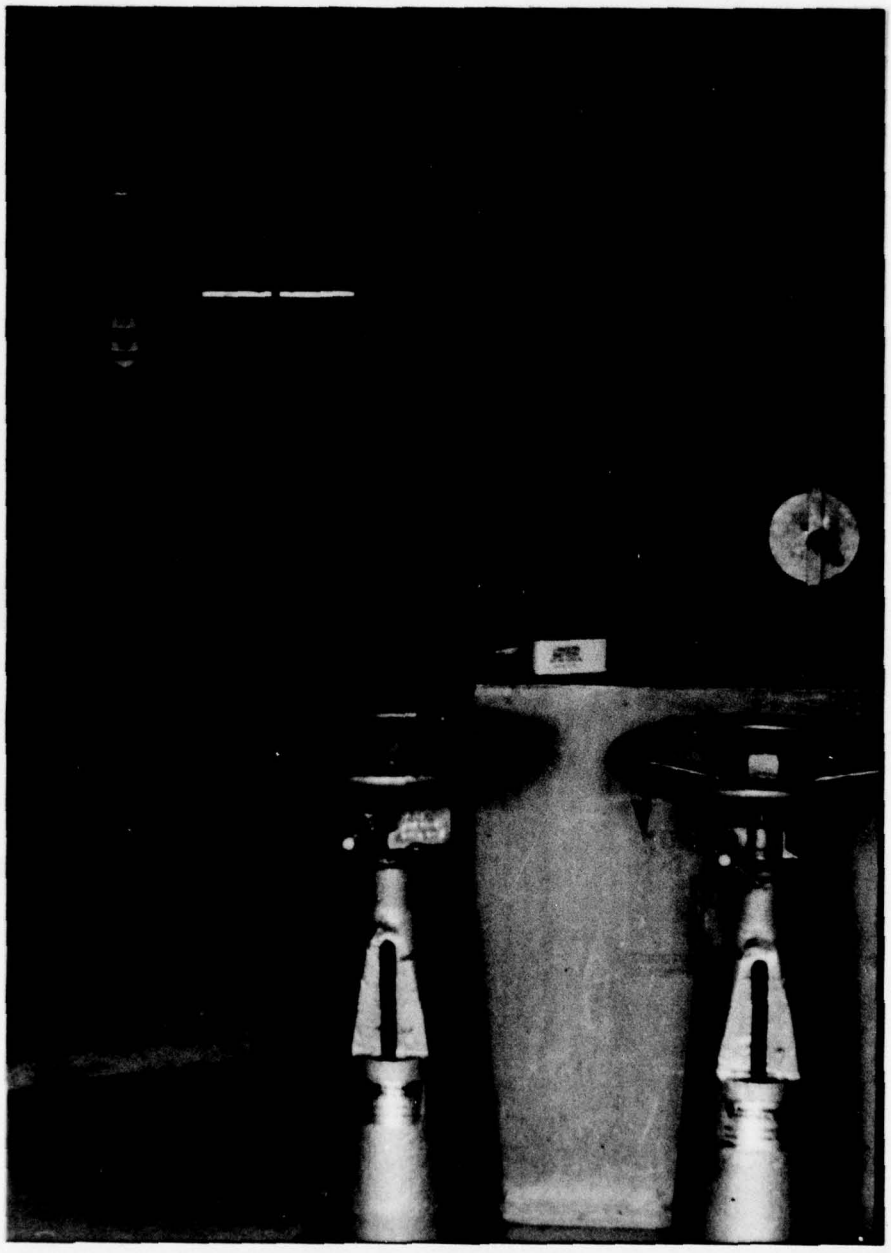


VIEW OF PRIMARY SPILLWAY INTAKE STRUCTURE
WITH TRASH RACKS INPLACE.

PHOTO NO. 2

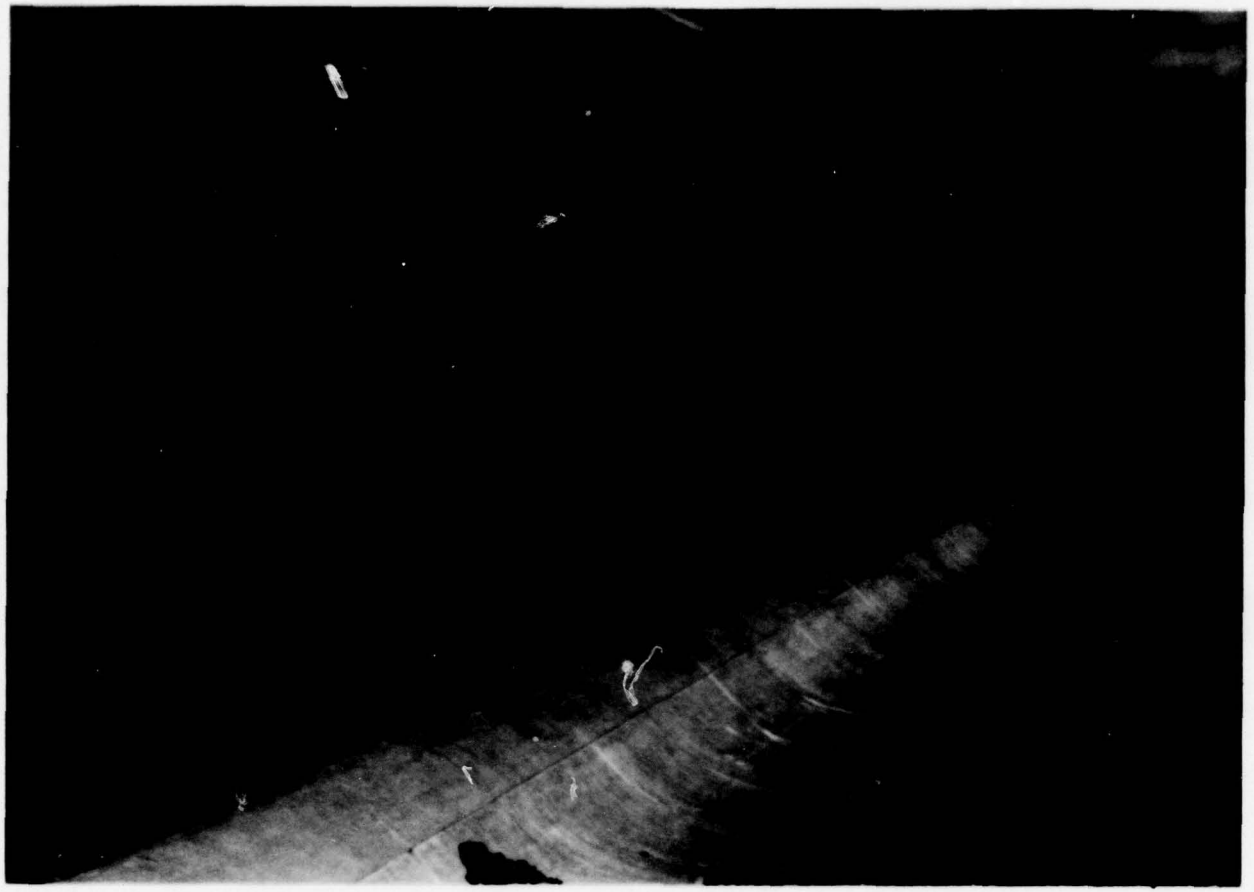
VIEW OF STILLING BASIN AND OUTLET CHANNEL
WHICH CONTAINS DISCHARGES FROM THE
PRIMARY SPILLWAY AND CONTROL TOWER.

PHOTO NO. 3



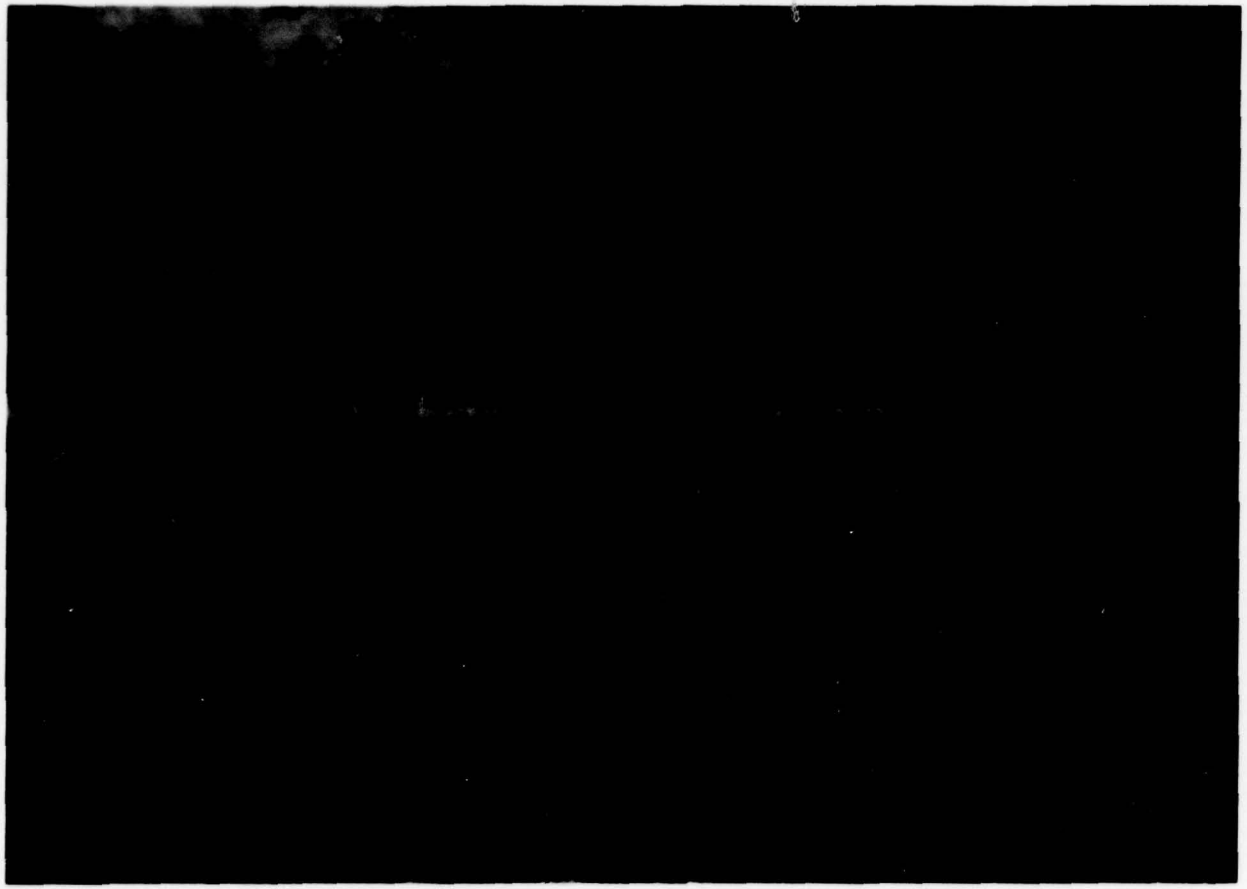
VIEW INSIDE CONTROL TOWER AT THE CREST ELEVATION
SHOWING INTAKE CONTROL VALVES AND THE USGS GAGE STATION.

PHOTO NO. 4



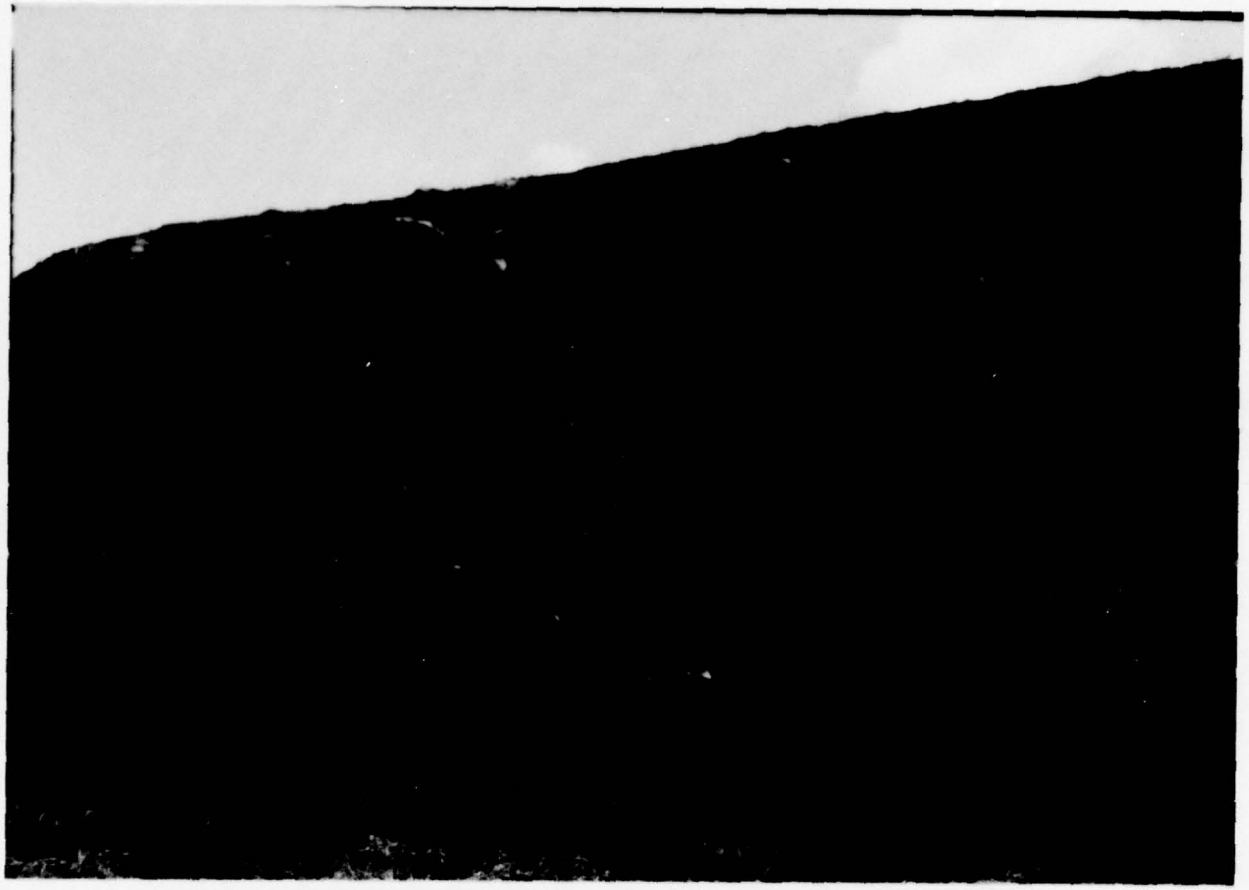
VIEW OF EMERGENCY SPILLWAY
LOOKING FROM THE RIGHT SPILLWAY ABUTMENT
TOWARDS THE LEFT ABUTMENT.
NOTE SOUTH DIPPING (DOWNSTREAM DIRECTION)
FOLIATION PLANES OF BEDROCK.

PHOTO NO. 5



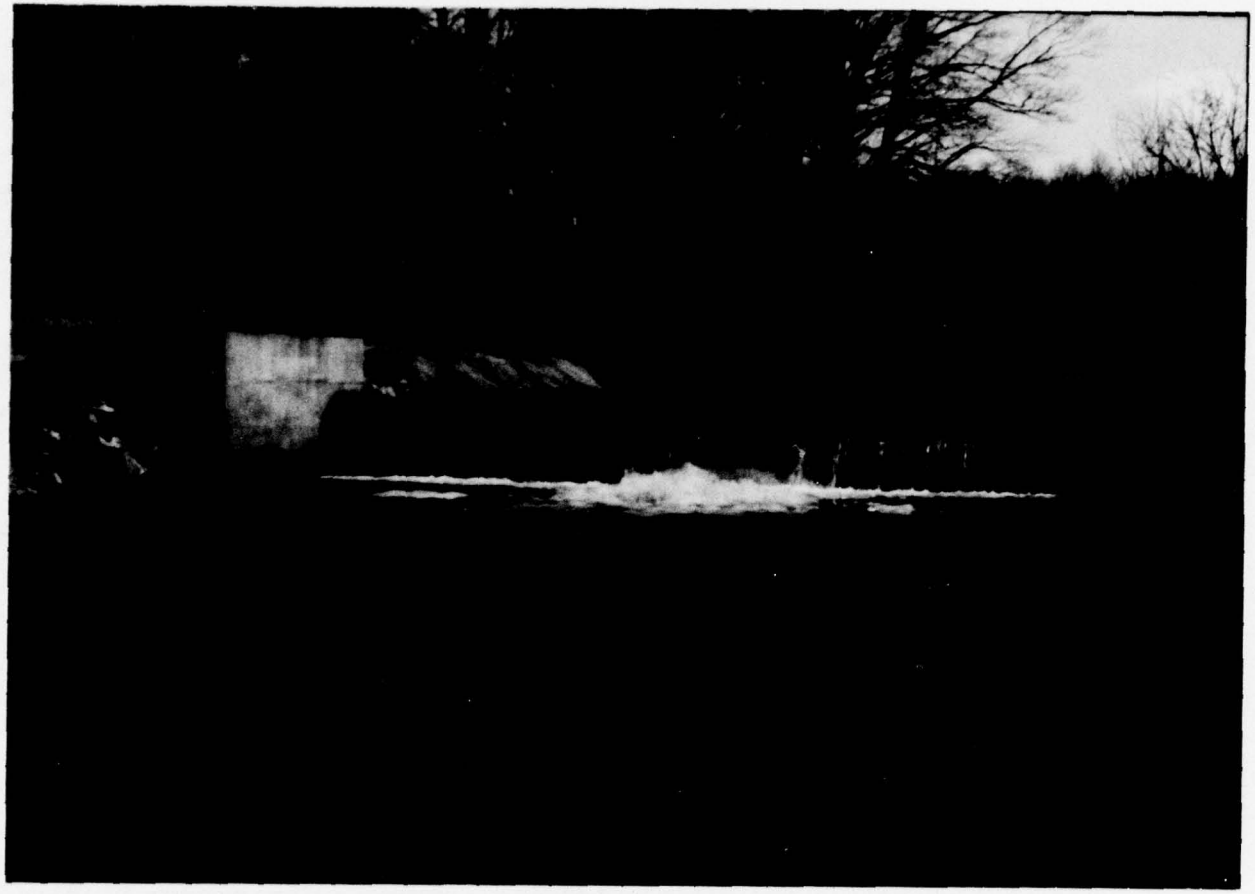
VIEW OF EMERGENCY SPILLWAY LOOKING UPSTREAM.
NOTE THE SEEPAGE IN THE DOWNSTREAM CHANNEL.

PHOTO NO. 6



EXPOSURE OF GRANODIORITE DOWNSTREAM
FROM THE EMERGENCY SPILLWAY LOOKING NORTHEAST.
NOTE THE HIGHLY JOINTED AND FRACTURED CONDITION OF
THE ROCK WHICH CONTRIBUTES TO LOCALIZED SLOPE SLOUGHING.

PHOTO NO. 7

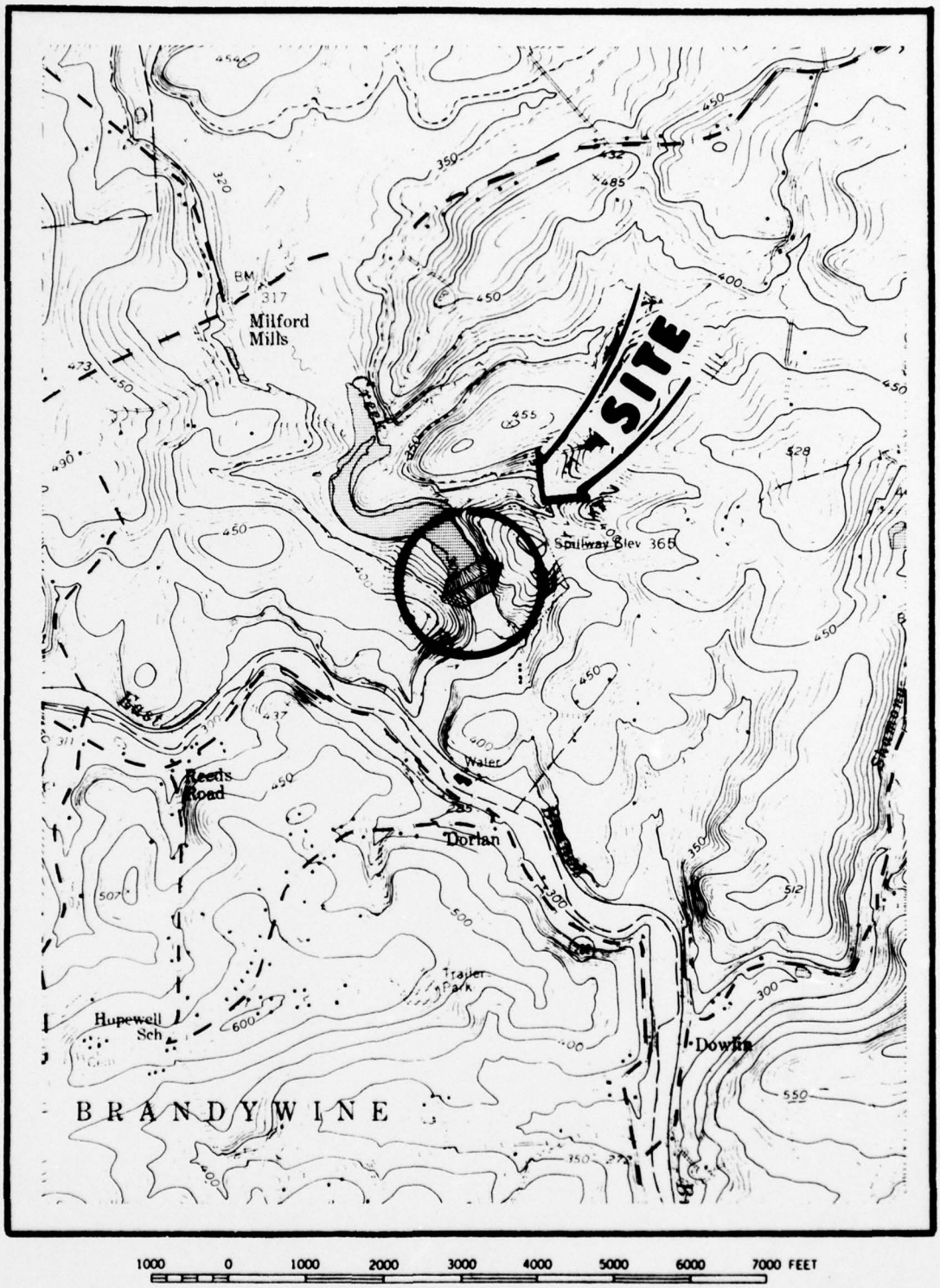


VIEW LOOKING UPSTREAM AT CHANNEL WEIR USED TO MONITOR FLOWS.
THE CONTROL HOUSE GAGE STATION IS
TO THE RIGHT JUST OUTSIDE OF CAMERA VIEW.
THIS FACILITY IS LOCATED APPROXIMATELY
900 FEET DOWNSTREAM OF THE DAM.

PHOTO NO. 8

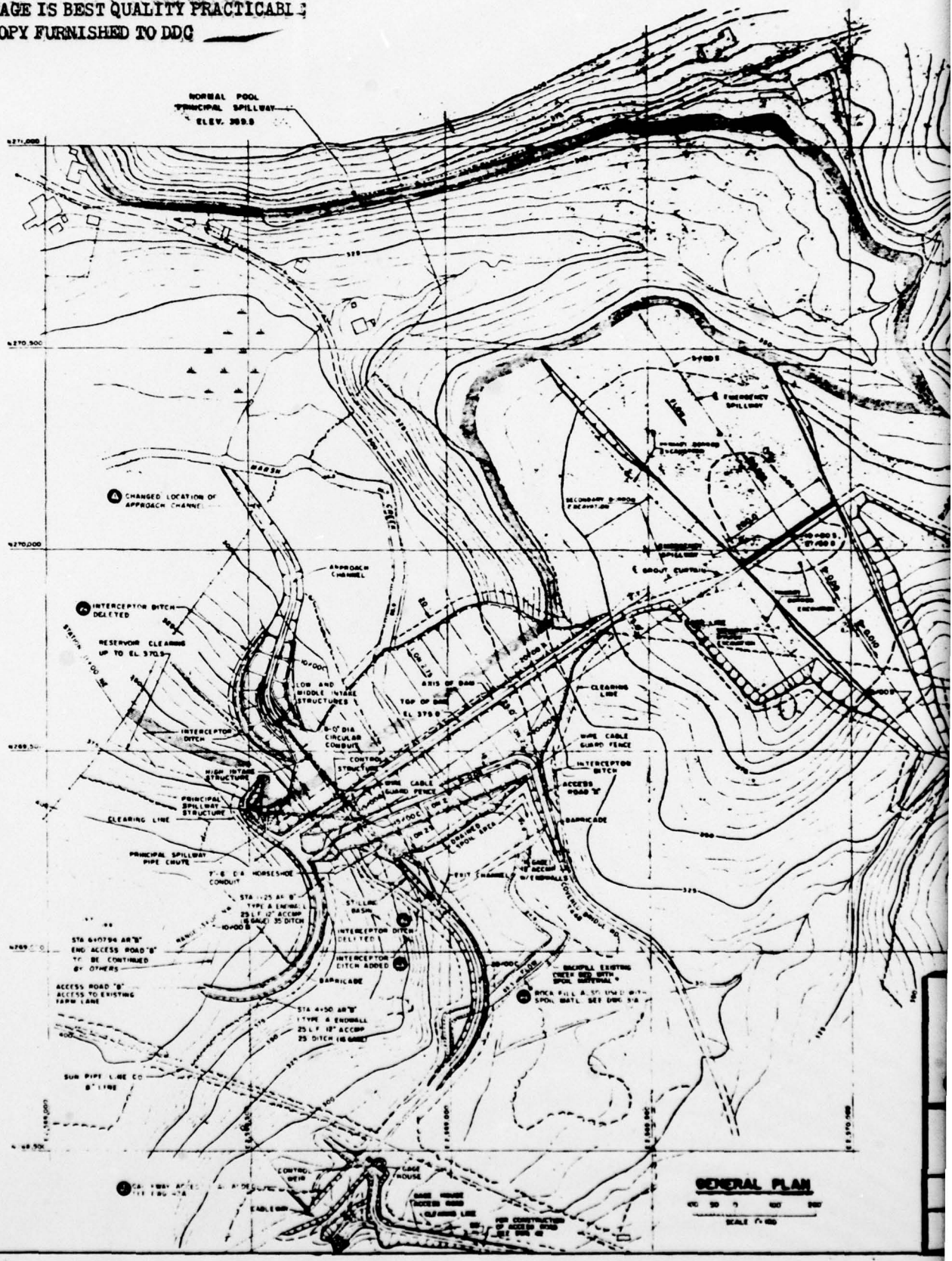
APPENDIX

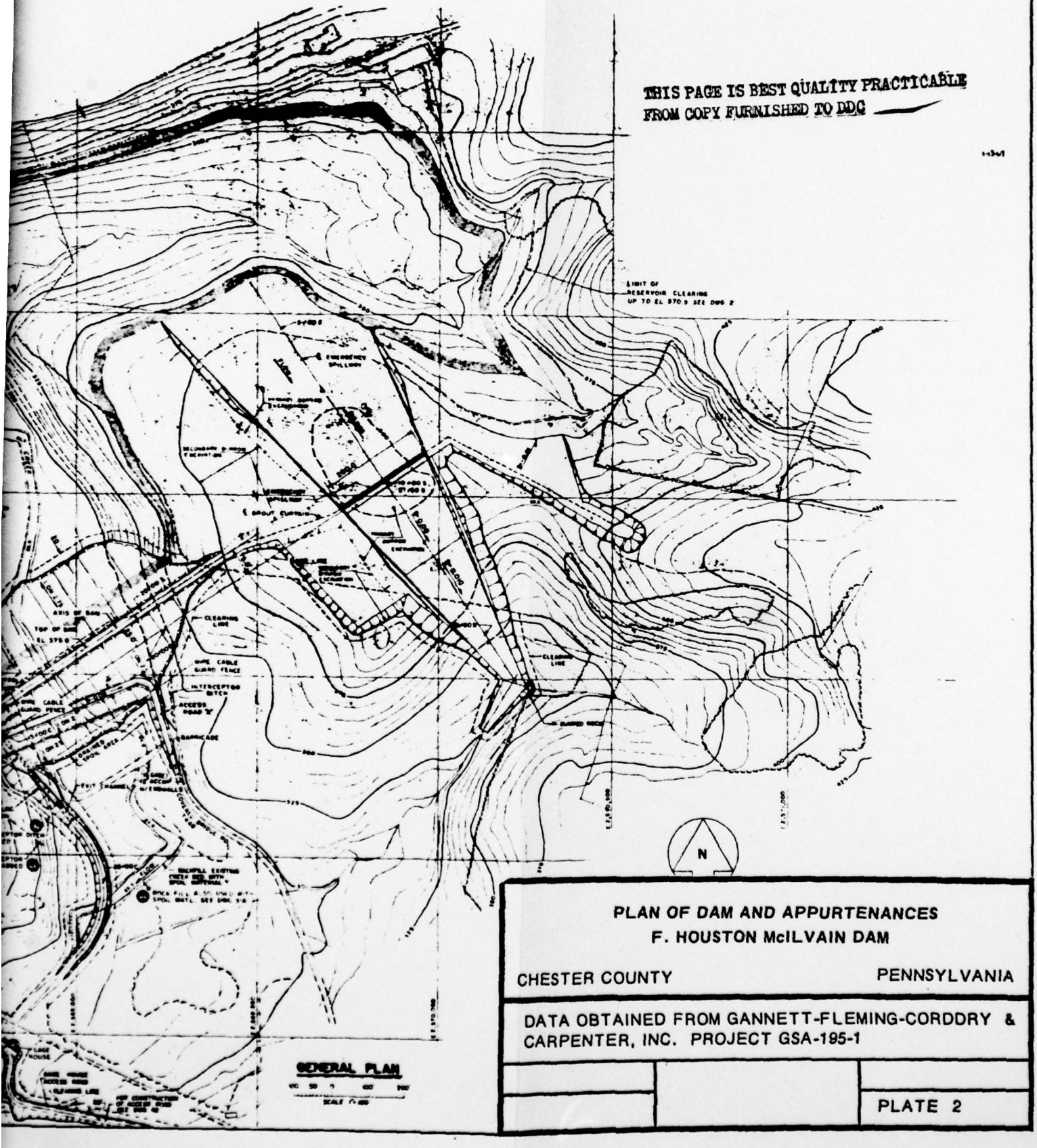
E



REGIONAL LOCATION PLAN
F. HOUSTON McILVAIN DAM
U.S.G.S. QUAD SHEET ' DOWNINGTOWN'

PLATE 1



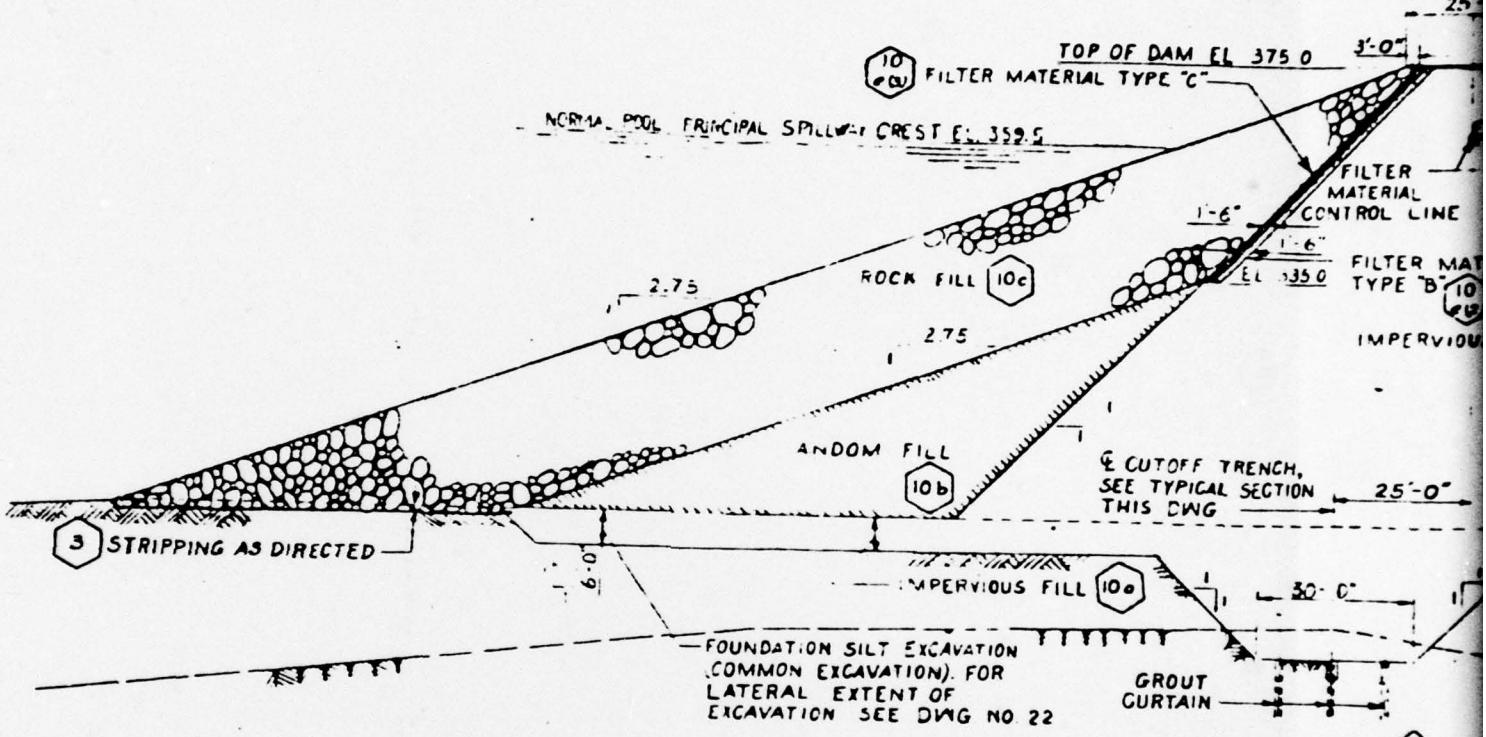


PLAN OF DAM AND APPURTENANCES
F. HOUSTON McILVAIN DAM

CHESTER COUNTY PENNSYLVANIA

DATA OBTAINED FROM GANNETT-FLEMING-CORDDRY & CARPENTER, INC. PROJECT GSA-195-1

PLATE 2



SECTION 4 1/2

SCALE

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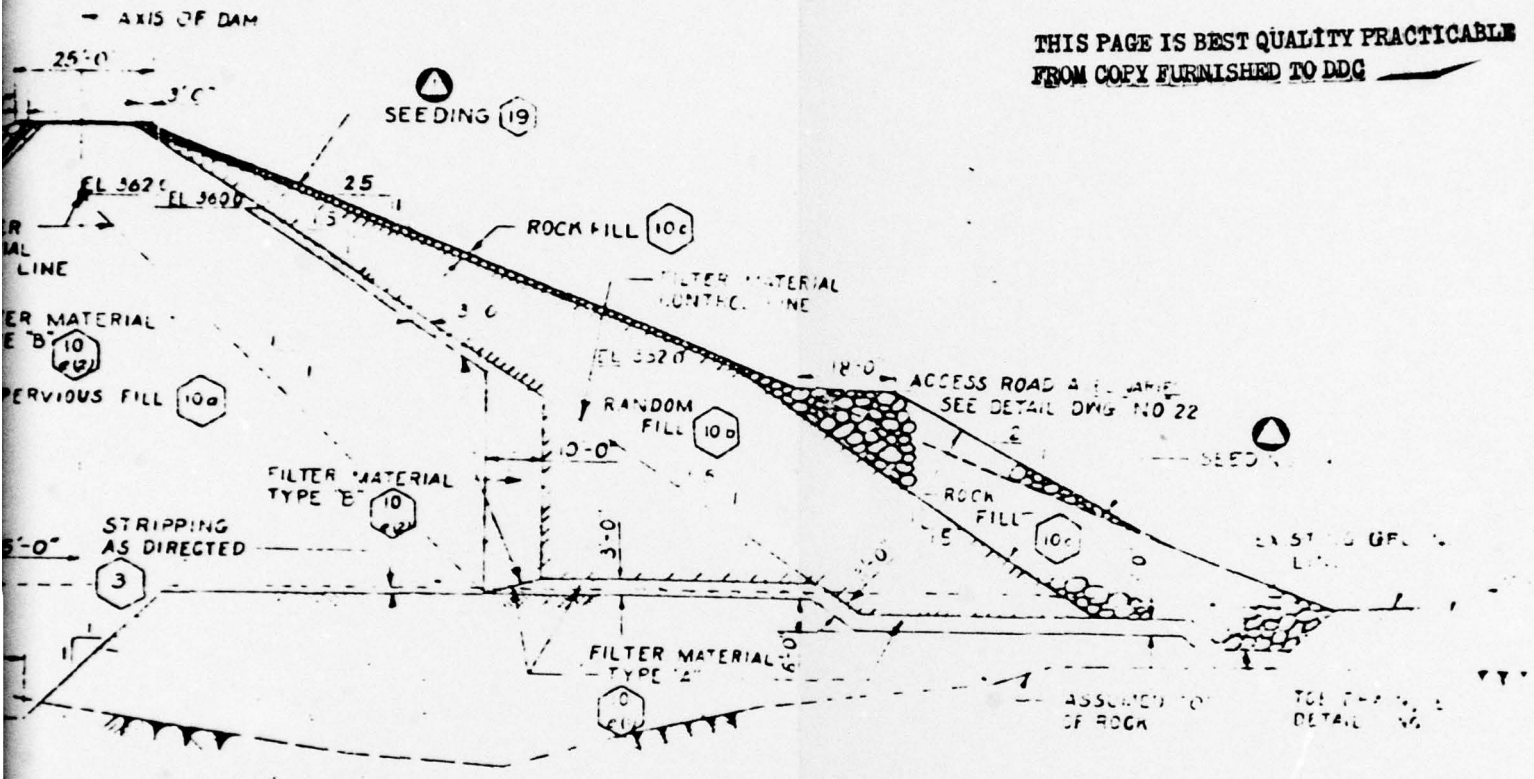
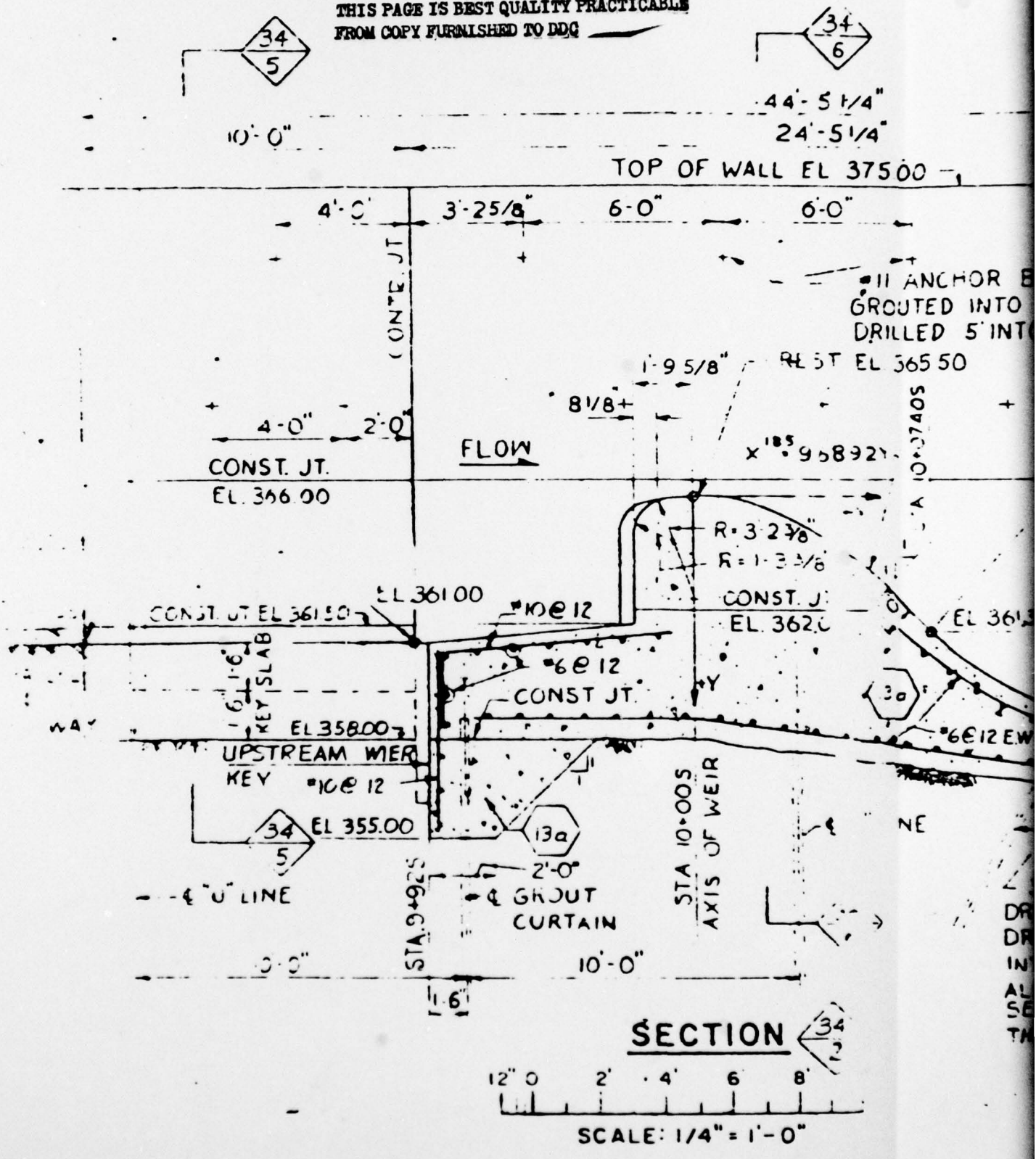


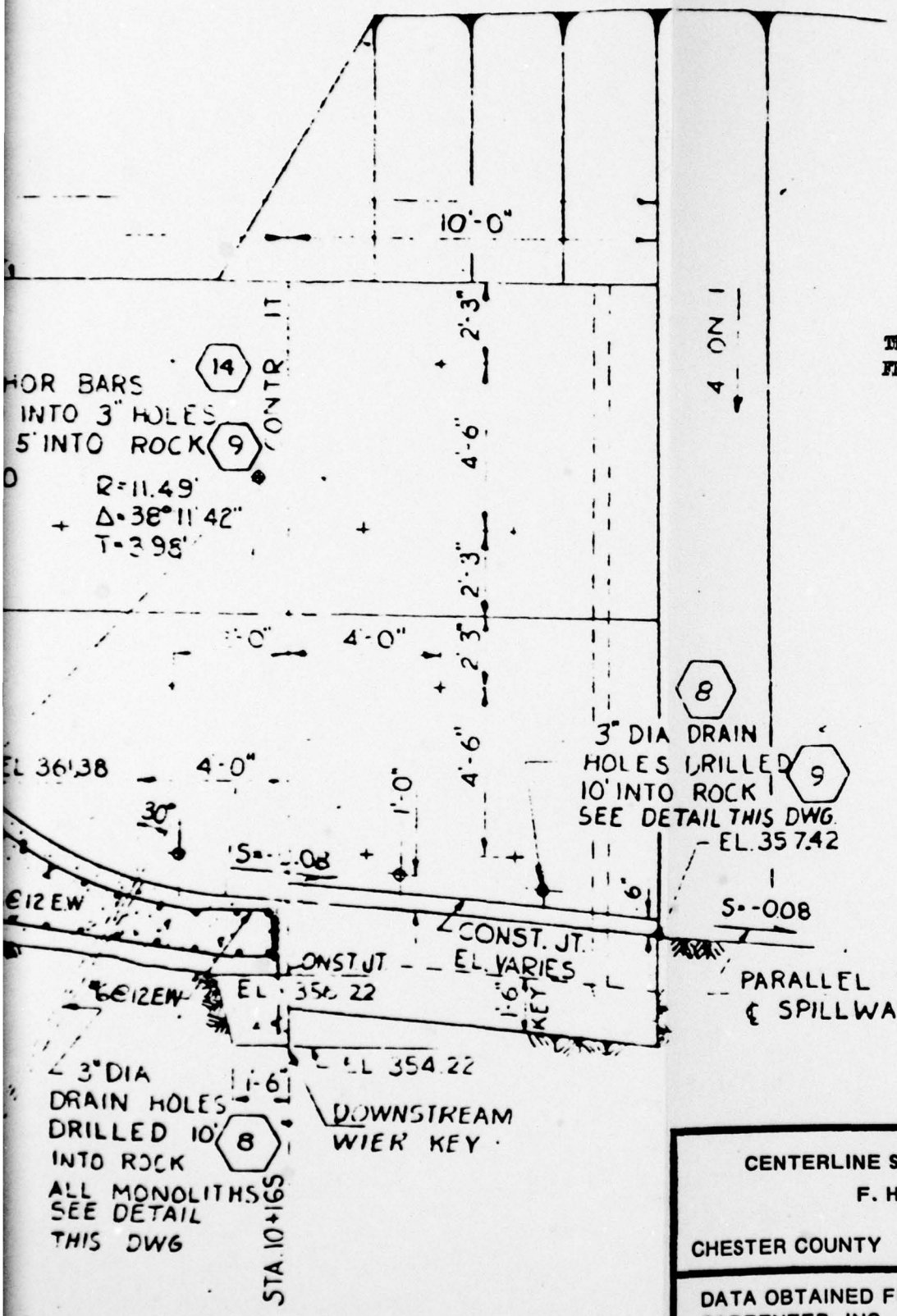
AT STA. 18+00 A

SCALE 1"=20'

SECTION ALONG CENTERLINE OF OUTLET WORKS F. HOUSTON McILVAIN DAM	
CHESTER COUNTY	PENNSYLVANIA
DATA OBTAINED FROM GANNETT-FLEMING-CORDDRY & CARPENTER, INC. PROJECT GSA-195-1	
	PLATE 3

2





CENTERLINE SECTION OF EMERGENCY SPILLWAY
F. HOUSTON McILVAIN DAM

CHESTER COUNTY PENNSYLVANIA

DATA OBTAINED FROM GANNETT-FLEMING-CORDDRY & CARPENTER, INC. PROJECT GSA-195-1

PLATE 4

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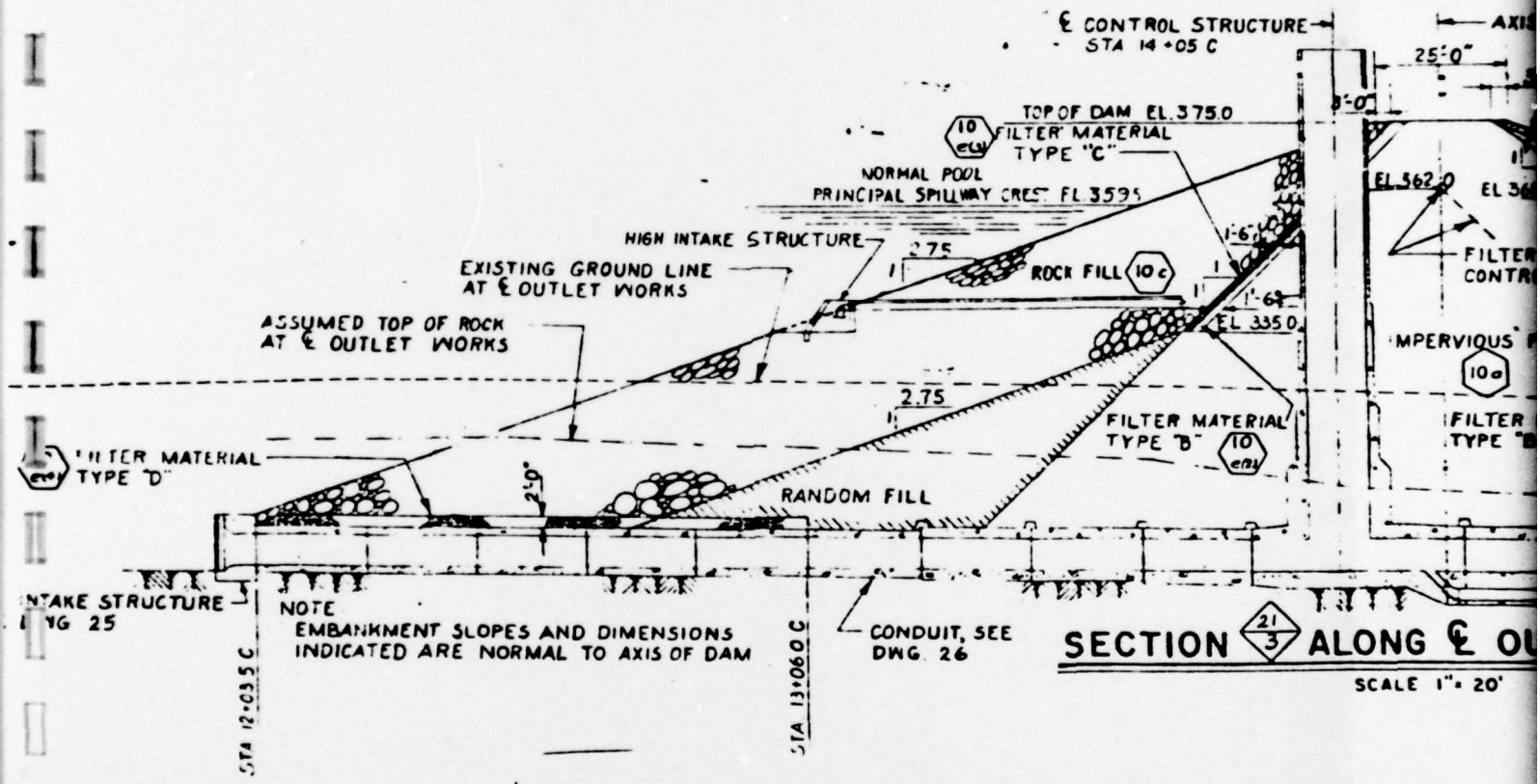
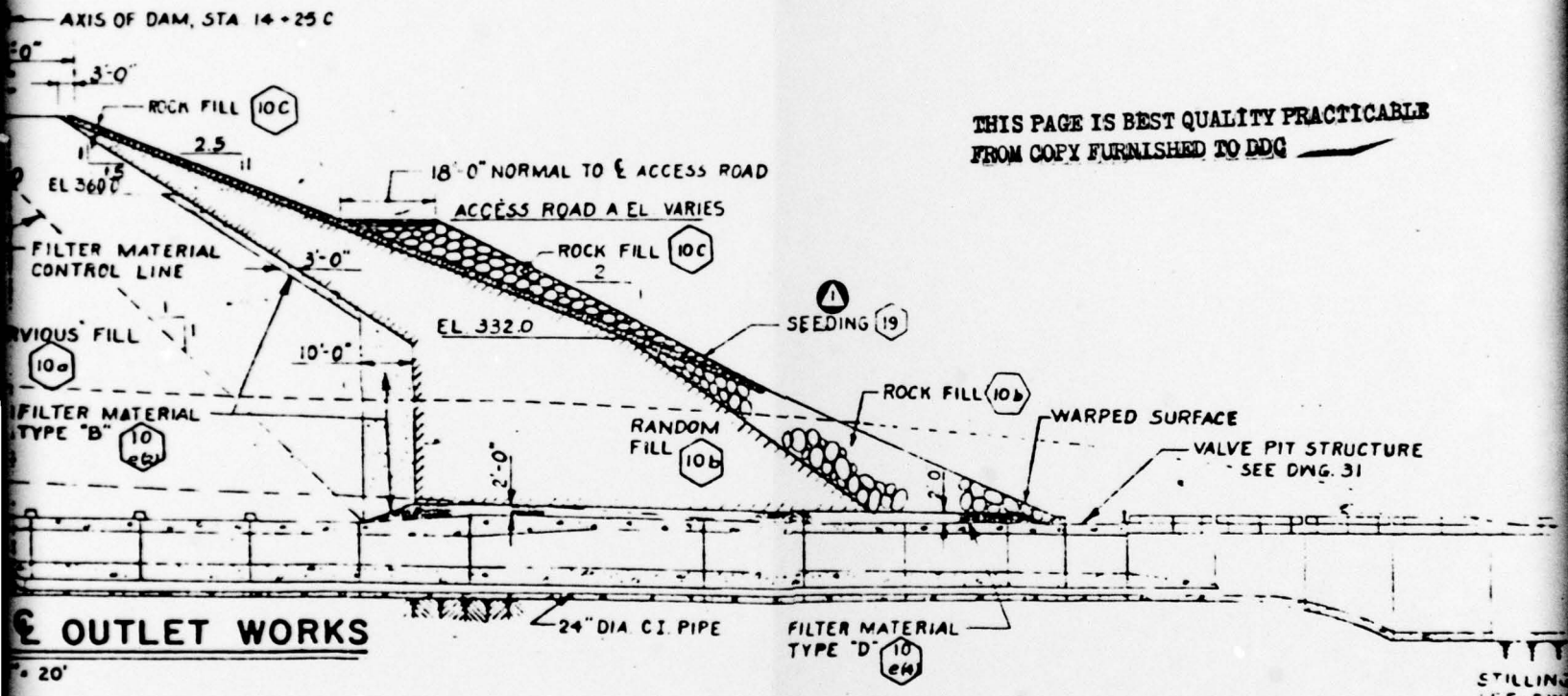




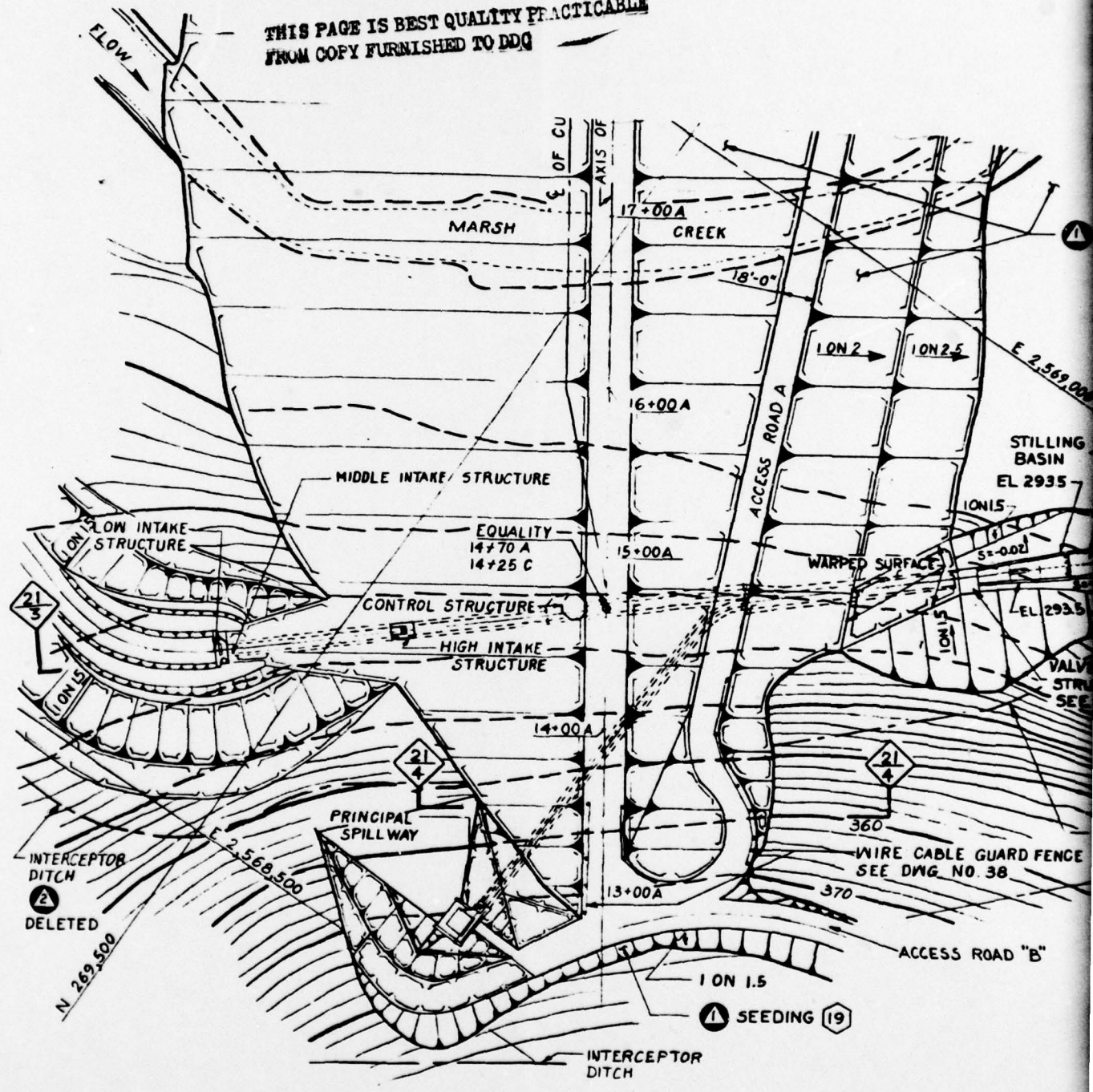
TYPICAL SECTION OF DAM & CUT-OFF TRENCH
F.HOUSTON McILVAIN DAM

CHESTER COUNTY — PENNSYLVANIA

DATA OBTAINED FROM GANNETT-FLEMING-CORDDRY & CARPENTER, INC. PROJECT GSA-185-1

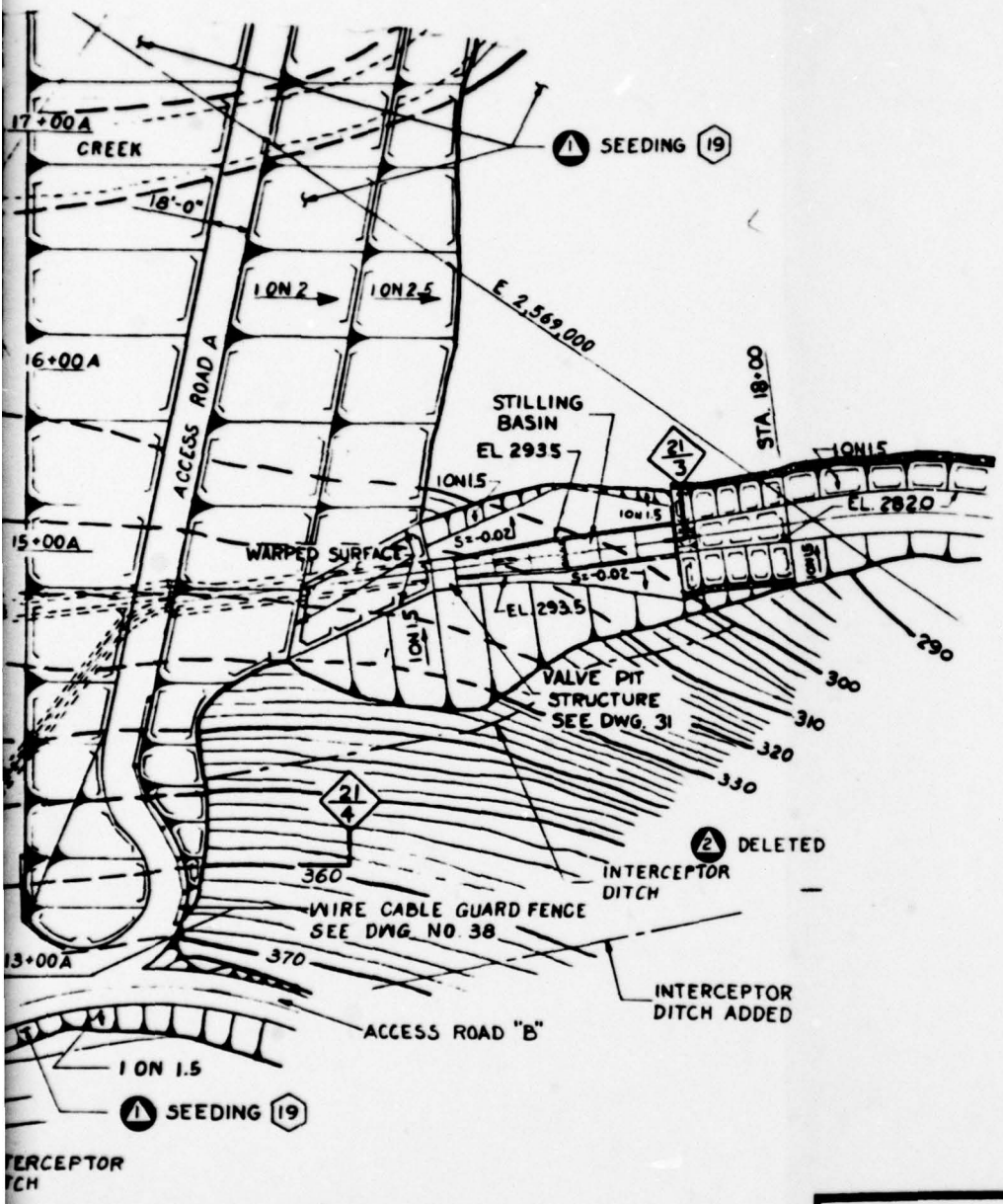
PLATE 5

2



EMBANKMENT PLAN

50' 25 0 50 100
SCALE 1" = 50'

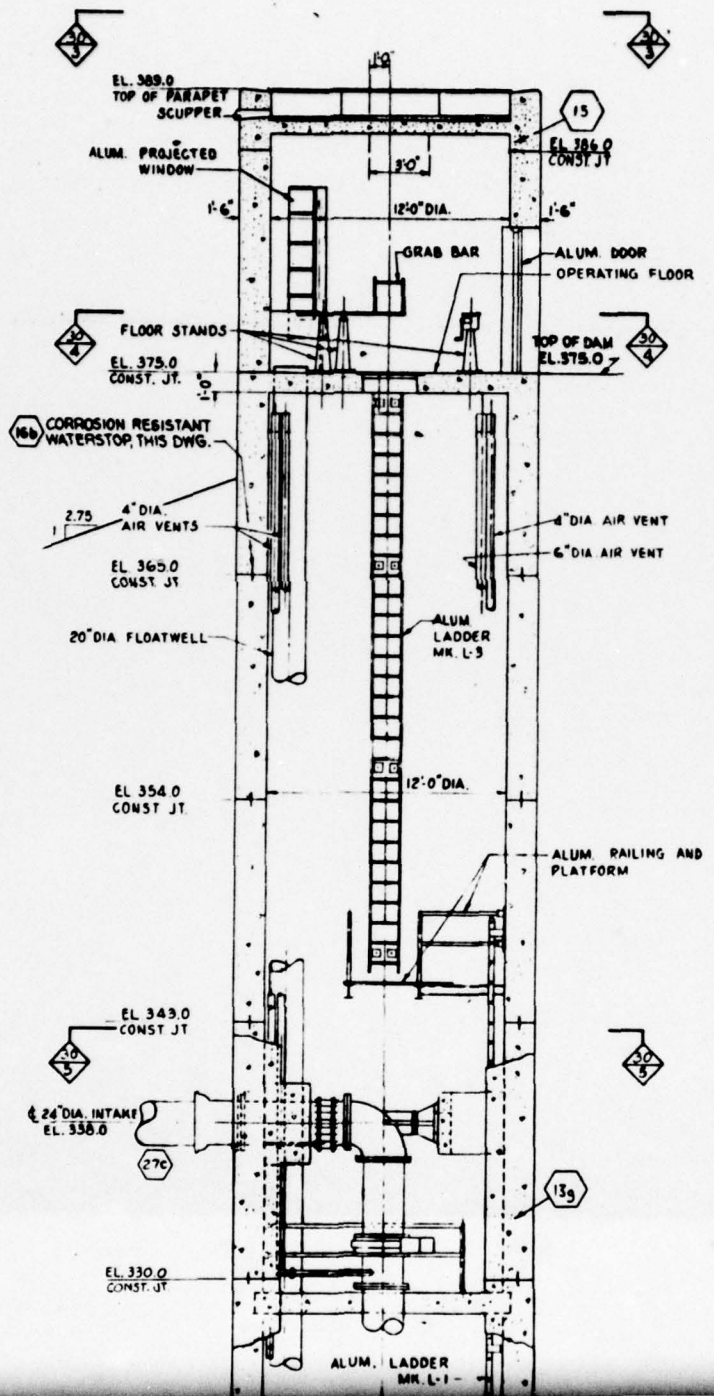


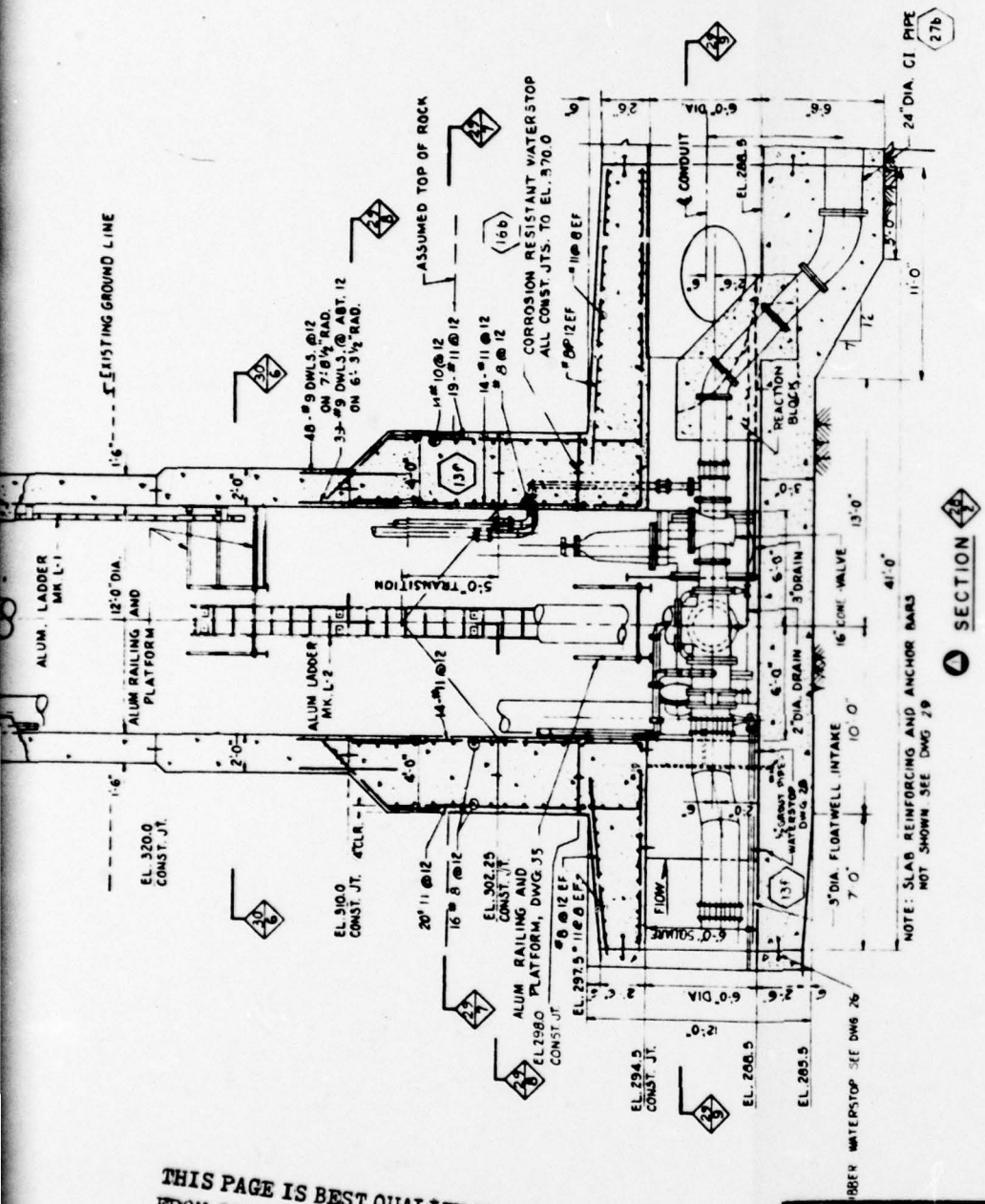
PLAN OF PRINCIPAL SPILLWAY ALONG RIGHT ABUTMENT
F. HOUSTON McILVAIN DAM

CHESTER COUNTY PENNSYLVANIA

DATA OBTAINED FROM GANNETT-FLEMING-CORDDRY & CARPENTER, INC. PROJECT GSA-195-1

PLATE 6





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SECTION OF CONTROL TOWER
F. HOUSTON McILVAIN DAM

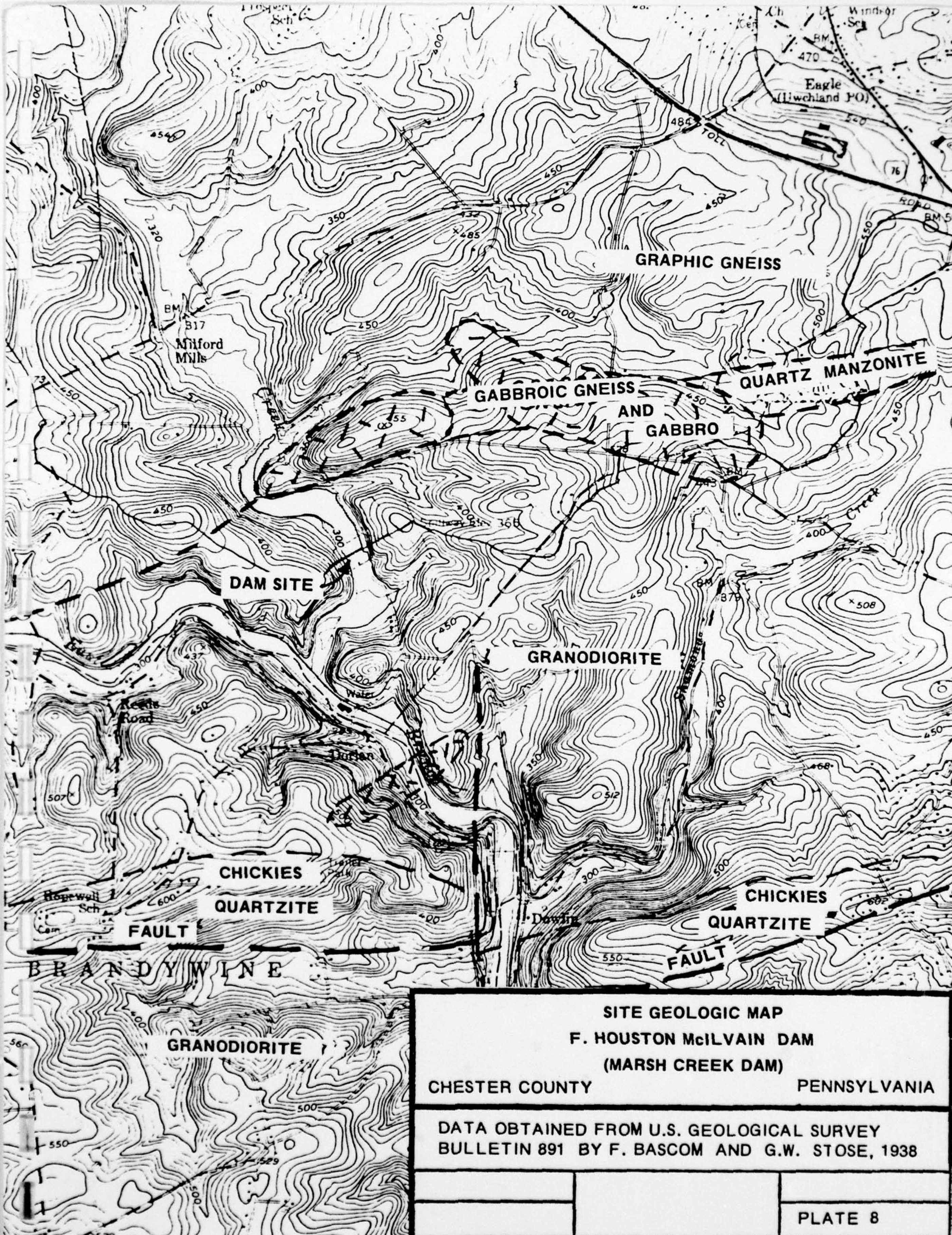
CHESTER COUNTY — PENNSYLVANIA

DATA OBTAINED FROM GANNETT-FLEMING-CORDDRY & CARPENTER, INC. PROJECT GSA-195-1

PLATE 7

2

1



SITE GEOLOGIC MAP
F. HOUSTON McILVAIN DAM
(MARSH CREEK DAM)

CHESTER COUNTY PENNSYLVANIA

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY BULLETIN 891 BY F. BASCOM AND G.W. STOSE, 1938

PLATE 8